Information and training packages would be available for the plants to use to get ready for the fall visual inspections.

Flaw evaluation guidelines are a longer term thing. It is to help us figure out how to long term manage this thing, but we are working on that right now also in case somebody does find something in the fall. You know, is there something that could be acceptable?

Review of repair and mitigation strategies is more of a long term thing. How do we wrap it up long term?

DR. KRESS: I'd like to return back to Dana's question for just a moment, the question of the potential that you won't SCRAM. Let's presume you break one of the control rod drive tube rods over near the periphery, and you suddenly have high pressure water and steam injected at sonic velocity and flashing as it comes out of that into this region where you have a cover over it and perhaps leak past, but the potential for building up pressure on one side, putting a torque on this head, perhaps creating a bending stress that might bend the other tubes to the extent that maybe one or two nearby won't be able to insert the rods again.

I think that's what Dana had in mind. The question is has that been looked at an analyzed from the standpoint of what the stresses actually are and whether there would be a bend?

MR. MATTHEWS: Those are -- Excuse me. I didn't mean to interrupt. The consequential damages are part of what we will have to factor into the risk assessment when we are pulling this whole thing together.

These are very hefty tubes, like I said, and you don't have to go very far away from a small ejection until the pressure drops off very rapidly. When it is hitting a round surface, you know, you've got an even lower force --

DR. WALLIS: Drops off because you have already blown out the shroud or something?

MR. MATTHEWS: No, I'm just talking about if you break a pipe. You don't have to go very far away from that --

DR. WALLIS: No, but it goes into a volume.

DR. KRESS: Yes, and it's pressurizing the volume.

MR. MATTHEWS: Well, if it pressurizes the volume, then you don't have the differential across it to bend it.

MR. SIEBER: I think the volume you are talking about is the volume of the shield cover, which is pretty flimsy. You can't pressurize that.

MR. MATTHEWS: I depends. It may be an inch thick. I'm not sure. It depends -- Plants vary on how thick that thing is, and it's not air-tight. I'm not even sure what is on top of it. It may actually just blow right up through there. I'm not sure. It's not --

DR. KRESS: I think that is the problem Dana had in mind there.

MR. MATTHEWS: You have large openings in there for ventilation. Those CRDMs have to be kept cool. So those openings and fans and air ducts -- the main reason you have the shroud is for an air duct.

MR. ROSEN: You may find that when you do the analysis that the pressure differential -- If you do a transient and pressure differential analysis -- never, never reaches very high pressure in that area.

MR. MATTHEWS: Across the --

MR. ROSEN: It vents in a lot of different directions.

MR. MATTHEWS: Yes.

DR. KRESS: I think that's the likely

result, yes. So you wouldn't have a bending torque on it.

MR. ROSEN: Exactly. As he said, it is intended to be a lot of ventilation in that area because of the heat. It's naturally going to be venting.

MR. MATTHEWS: The insulation packages that it is venting into -- you know, those are just -- they are light weight mirror insulation or they are blankets or stuff like that. It's not a sealed-up area.

DR. WALLIS: -- constant for thermal distortion by heating up one side to 600 degrees when the other side is cold is fairly long. So you think that distortion won't happen until you have SCRAMed and everything is fine?

DR. BONACA: Still, I mean, one thing that is important to note is that the ejection accident by the expectation of the FSAR is not a 10^{-3} event. It's supposed to be a much more unlikely event than that, and that the most severe case is the zero power case where you essentially eject the rod, and you create that by having an effective SCRAM.

I mean, you have one rod out, and the rest comes in. Shut down the reactor, and you have the highest worth out, just because -- and you are blocking core. So I mean, it's not an issue that can be downplayed. I think it has to be evaluated, because it has significance.

CHAIRMAN FORD: I would like to open up the meeting to the subcommittee for any last minute questions. What I plan on doing is stopping at around about 11:30 for lunch until 12:15. We'll cut 15 minutes off lunch, and then we will go straight into the NRR presentation.

So any last minute -- Graham?

MR. LEITCH: I would like to hear a little more about the nondestructive examination that is being contemplated. I guess I see, first of all, what's been done so far is a visual examination on top of the head. I notice from the pictures there were some dye penetrant examination beneath the head.

What is contemplated? Is this an ultrasonic demonstration? What are we talking about? PT? UT?

MR. MATTHEWS: From an under-the-head standpoint, you really want to do as much of this robotically as you can, because it's a very high dose -- very high dose environment.

In the early Nineties technology was

developed for examining the ID surface of the penetrations, and that technology was an eddy current probe that examined the ID surface looking for ID connected flaws. If anything was found, UT technology was available to go in and size those flaws.

It was all geared toward ID connected flaws, because that's the dominant thing we had seen at that point in time. There were -- In the mock-ups and the demonstrations that were done in the early Nineties or mid-Nineties, there were circ flaws on the ID of the nozzle. Looking for those also, but we didn't have any OD initiated flaws in the mock-up.

So, basically, we don't have any qualified techniques for looking for this kind of situation. We are working to get mock-ups built. We are working to develop the techniques.

Primarily, the only way we can query that volume right now is a UT examination for the tube. Some vendors are saying they are developing eddy currents for looking at the OD of the tube below the weld for the OD -- or looking at the weld material itself for connected flaws there. They haven't been demonstrated. We are working to try and get those things set up and see if those technologies are available.

The plants that are going to be doing any kind of volumetric exams -- it would be -- Westinghouse plants have an interfering -- and I'm not sure about the CE. They have an interfering thermal sleeve. So they only have a gap, a small gap between the ID of the penetration and the OD of this thermal sleeve. So anything delivered to the ID of the penetration has to be on a kind of a saber, and it's a saber that is rastered back and forth around the thing, looking for eddy current, the primary technology.

Now we are talking about putting UT probes on there and trying to detect flaws anywhere in the tube, ID or OD. It takes longer, and it takes a different set of transducer packages.

It depends on whether you are looking axially or circumferentially, and that stuff is being worked on by the inspection committee and by the EPRI and DE center to try and build these mock-ups and work with the vendors, who are themselves working on the techniques.

MR. LEITCH: But an inspection of the weld per se, you're talking mainly about the tube. The weld itself -- it's a very complex geometry.

MR. MATTHEWS: Yes, it is, and the weld is going to be very difficult to examine volumetrically.

MR. LEITCH: So the 25 plants that are going to do inspections -- I guess I'm not real clear what that means.

MR. SIEBER: They are visual.

MR. MATTHEWS: Those were intended to be visual, and I'm not sure the NRC is going to agree with that. But, you know, that's our intent.

MR. LEITCH: And then if the visual shows something, then --

MR. MATTHEWS: Yes. Anytime you find something on top of the head, you know, all bets are off. You got to go figure out what it is, and you got to figure out how bad it is and what the extent is, and if it is coming through-wall, you got to repair it.

MR. LEITCH: So these NDE techniques that are still under development are not intended to be operational by the fall outages?

MR. MATTHEWS: Some plants will probably do a best effort, which means they will put some probes in there and see what they see. But, you know, it's not a PDI type qualification. We don't have the time. We don't have the blocks, and we don't have the capability to do that type of qualification at this point in time. Eventually, we'll get there.

You know, the ID connected flaws -- we got there. We had very good qualification programs for all of the vendors who were doing those types of inspections. We are not there yet on the OD flaws.

MR. LEITCH; Now the photographs there at Oconee show that you had done some PT there, evidently.

MR. MATTHEWS: They did PT. What they did at Oconee on the first one they did, they found the boron. They did the eddy current, and there was nothing on the ID of the tube. Are you sure it's leaking? Then they went back, and they did more exams, and they couldn't find anything, and they finally did PTs.

The only thing they saw on the initial PT was a couple of little spots. We'll clean that up and, as they ground it into an axial flaw that was in the weld and the OD of the tube. The PTs that were done on Oconee 3 were on the leakers. Once they knew it was leaking, they went in, and they did PT on those leakers.

Did you do any PTs on any other nozzles? Those were the only ones they did PT on. PT -- you got a person standing there.

MR. LEITCH: Yes, it's very high in radiation.

CHAIRMAN FORD: Any other questions?

MR. ROSEN: The PTs were under-head PTs. Right?

MR. MATTHEWS: Under the head, yes.

DR. BONACA: At Oconee, did they detect all the nine leaking nozzles by visual inspections in the first pass?

MR. MATTHEWS: Yes. I believe it was first pass. They looked. They saw them.

MR. ROBINSON: Mike Robinson again. We initially identified six leaking nozzles with the head on the vessel. We took the head off the vessel, did the clean-up, and at that point we saw three other nozzles that looked suspicious. We called those as potential leakers, and did our normal pre-repair NDE on those and, once we saw some indication there, we said we had the nine leakers.

DR. BONACA: The reason that I am asking is that I am still a little bit concerned about detectability. You know, they pointed out that it is difficult to distinguish those boron crystals on top of the head from leakage from the flange, from actual leakage around the nozzles.

The reason why I am raising it is that plants will go through a visual inspection first, and is it so sure that just visual will identify these cracks?

MR. MATTHEWS: We feel that visual will find it.

DR. BONACA: Well, in this case, for example, they only identified six. Now if those six were not leaking, the other three would not have been seen.

MR. MATTHEWS: No. Six were identified before they even took the head off the vessel. The other three were identified once they did a more thorough exam with the head on the stand.

DR. WALLIS: It's not clear that these leaks have come out -- you see something coming out the top or they are actually the worst thing. You could have a very fine leak of steam with a crack actually growing circumferentially inside, which wouldn't -- you know, you have a very small leak, because you've got a very tight tube up there. It doesn't really tell you what is happening inside where the crack could be growing circumferentially.

MR. MATTHEWS: Right. Well, the only three circumferential flaws that have been found were also associated --

DR. WALLIS: But you are lucky that you have a big enough leak before you get the circumferential crack growing that you can see it. It's a race between these different things that are going on at the same time.

MR. MATTHEWS: We haven't seen any evidence of any kind that would have a crack --

DR. WALLIS: But the leak is not a symptom of the degree to which the circumferential crack has grown.

MR. MATTHEWS: Oh, that's true.

DR. WALLIS: It's a symptom of the degree to which an axial crack has grown, presumably, and also the ability of this pressure -- this what do you call it, fit, this tight fit, to let something come out.

MR. MATTHEWS: To let it out, yes. We as an industry don't want to manage this issue by looking for leaks. That's not the right way to manage it. We want to develop the tools and a program for the industry that is going to be more proactive than trying to find a leak and fix it.

Just for the near term, the technology is where it is, and that is what we have, and that is where we were trying to go for this -- Fall outage is what we are saying.

CHAIRMAN FORD: Unless there are any other major questions right now, I would like to adjourn the --

DR. WALLIS: A procedural thing: Are we going to give some advice about what to say before the main committee this afternoon? I think he needs some advice about what to tell us tomorrow, because we can't possibly go through all this tomorrow.

MR. MATTHEWS: Oh, no.

DR. WALLIS: Are we going to do that this afternoon?

CHAIRMAN FORD: Let's hear the NRR, and then we'll give advice.

DR. BONACA: Also we should ask the NRC if maybe the staff wants to just give a presentation without any --

CHAIRMAN FORD: Hold on, guys. We are adjourning now until -- Recess until 12:20.

(Whereupon, the foregoing matter went off the record at 11:36 a.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(12:23 p.m.)

CHAIRMAN FORD: I would like restart this subcommittee meeting. Jack, would you like to introduce your team?

MR. STROSNIDER: Yes. I have a few opening comments, and then I will introduce the staff.

My name is Jack Strosnider. I am Director of the Division of Engineering. First of all, I wanted to start off by thanking the Committee for setting up this session and hearing this issue today. I know you have a very busy schedule. However, we do think it is very important that the Committee understand this issue and understand about the staff's approaches to dealing with it.

We see this as a major issue in terms of addressing our principal performance goal of maintaining safety, and that is why we are going forward with the Bulletin. So, again, I think it is important for the Committee to understand what we are doing there.

I also want to say thanks to Larry Matthews and the industry for their presentation. I think, if nothing else, I want to say we appreciate that they went first today.

Seriously, I think they did give a good summary of what the issue is, and also what we know and what we don't know. That is part of the reason, when we talk about what we don't know, why we are looking at a bulletin.

The bulletin we are talking about is a request for information, and that request for information is intended to help us verify compliance with existing regulations, and also to determine what additional future regulatory actions might be appropriate.

With regard to some of the questions -- and I think the Committee did a very good job this morning focusing in on some of the major issues which have also been of concern to the staff. I am going to tell you right up front that the staff doesn't have the answers either.

So when you go forward with your discussion this afternoon, recognize that we don't have all the answers. Again, that is the reason we are going out with this request for information.

Now requests for information can sound -- That might sound somewhat benign, but in fact, I think when you see some of the discussion we had with regard to issues like how do you qualify your visual examinations and things like that, that there are some challenges in there for the industry, most definitely, in order to be able to answer some of the questions and address the technical issues and the regulatory aspects.

As far as expectations or requests from the Committee, we are on a schedule for issuing this bulletin August 1. That's our milestone. We will go up to the Commission something on the order of ten days or so before that through an information Commission paper.

We would like to see a letter from the ACRS that would support that schedule and provide your perspective on the staff's approach technically and process in terms of how we are addressing the issue.

With that little introduction, I would just point out that then we have at the table -- We have Al Hiser and Mark Reinhart, Tad Marsh and Ed Hackett in the Office of Research.

Al is going to walk through basically what the bulletin request looks like, some of the information we are looking for, and some of our thought process, what's behind that.

Mark is going to talk about the risk perspectives that we have been able to develop to date. Ed Hackett is going to summarize for you an effort that the Office of Research undertook with regard to this issue. They have contracted four experts who are sitting at the table across from us here to take a look at this issue from a technical point of view, and he is going to summarize their efforts and going to point out that we got a lot of really good support there. His people did some hard work in a short time. We appreciate that effort.

Tad Marsh is going to talk about the process, what the generic communication process is and, I think, a little bit about the schedule, some of which I just mentioned.

So with that, I will turn it over to Al Hiser.

MR. HISER: Thank you. Hi. I am Alan Hiser with Materials and Chemical Engineering Branch of NRR. What I want to do is discuss the NRC staff activities in this area and, in particular, the draft bulletin that the staff is proposing at this point.

(Slide change)

MR. HISER: The slides that are in the package that have been handed out include a lot of background, and what I'll do is skip over that and jump right to slide 5. But in addition, I want to talk about the staff approach, applicable regulations, the staff assessment that has been performed to date, and then go into details on the proposed information request in the bulletin.

In terms of safety perspective, again on slide 5, failure of a CRDM nozzle does constitute a LOCA and control rod ejection, which are analyzed events. Some of this, Mark Reinhart will go over a little bit later, some of the more detailed things. I just wanted to sort of take a big picture perspective on things.

From existing PRAs, one would indicate that a level of risk exists here that requires increased attention. I think that is what we are putting on this.

Now to go back a little bit to Larry's presentation, the worst case crack that was found at Oconee with a high susceptibility plant did have a remaining ligament margin of about 6 to failure. There is about 180 degrees remaining in the crack. Failure would be predicted to occur with about a 30 degree ligament remaining.

DR. WALLIS: Do you know that by some kind of visual examination?

MR. HISER: Do I know which part of it?

DR. WALLIS: How do you know that you've got this much left?

MR. HISER: The structural integrity calculations.

DR. WALLIS: Did you cut the thing apart to find out or how did you know that you had this big a ligament left?

MR. HISER: That's what the licensee indicated from their examination.

DR. WALLIS: Did they use a surface visual examination, superficial?

MR. HISER: I believe they did ultrasonic -- I'll let Mike Robinson address that.

MR. ROBINSON: The 165 degree arc is the arc link that was repaired once we found --

DR. WALLIS: You actually took it apart and looked at it?

MR. ROBINSON: We looked at part of it, but in the course of repairing the indication, we ground out an area that was in the 165 degree --

DR. WALLIS: so it's a pretty good measure of what happened?

MR. ROBINSON: Yes,sir.

DR. WALLIS: Thank you.

MR. HISER: Based on this experience, we

have no reason to conclude that cracking won't affect additional units. We have no reason to believe that in Oconee units, in particular, with the circumferential cracking are unique in any way fabrication-wise, construction-wise or operation-wise that would indicate that they are the only units that would be affected.

We do think that timely, effective inspections would provide additional information on the extent of the problem, and would provide us with confidence that safety is maintained and that regulatory requirements are satisfied.

(Slide change)

MR. HISER: Now looking at the overall staff approach to this, we held a public meeting with the industry on April 12 of this year. We requested, and the industry submitted, a report in May. Larry went over, I think, in pretty good detail the contents of that report.

The staff did submit questions to the MRP initially in a FAX form and then formally near the end of June, and we held a public meeting with the industry in early June where they presented initial responses to our questions.

From the information that we have seen,

the staff has concluded that we should propose a generic communication. The purposes of this communication are to assess compliance with regulations and to provide staff with information on licensee actions that they propose to address the issue.

In particular, we are looking to determine the prevalence and severity of PWSCC in vessel head penetration nozzles. The one caution I would lay out is that the staff is in, say, the first step of a multi-phase effort where at this point we are in an information gathering phase and, based on the information, we will determine the need for additional regulatory actions and what the nature of those actions should be.

DR. WALLIS: On page 5 you talk about timely effective inspections. Are you going to tell us what kind of inspections those are?

MR. HISER: I will provide some details on what we think they should be.

DR. WALLIS: Are you going to tell us that looking for boron crystals on the outside is a true indication of what is happening inside?

MR. HISER: In some circumstances, we think that can be the case.

DR. WALLIS: Okay. That's a pretty equivocal answer.

MR. HISER: Very equivocal situation.

(Slide change)

MR. HISER: What I would like to do is go ahead and skip slide 7, which would just be restating what Larry described this morning, and then just go into a little bit of detail of the staff concerns with the MRP report.

The first thought that the staff had on the report is that the susceptibility model has large uncertainties to it. We know it doesn't encompass all of the factors that are important. It only looks at operating time and the time that the plant was operating -- operating time and operating temperature.

We do believe that the susceptibility model provides a useful plant ranking relative to Oconee Unit 3 from which the staff has some ideas on how to address the overall problem, and we do acknowledge. I think the industry addressed a little bit this morning, that this is not a predictive model.

Plants predicted to be within X EFPY of Oconee Unit 3 will not necessarily develop cracking at that time. It may be subsequent to that. It may be prior to that. It's not a predictive model. It is just a relative ranking of where the plants lie.

DR. WALLIS: Now this morning we talked about uncertainty, and we didn't get some quantitative evaluation. Did you do a quantitative evaluation of these uncertainties?

MR. HISER: No, we haven't.

DR. WALLIS: It would seem important to do that, because you've got this nice curve. But if there is a great deal of uncertainty, then it doesn't tell you as much as you would like it to tell you.

MR. HISER: I think, as we go into the staff presentation, you will see that we are not focused on the susceptibility model. What we are doing is allowing it to give us some information on which plants may be more susceptible and to help us in our information gathering process.

DR. KRESS: Now one view could be taken, that Oconee might have equivalent stresses or even stress distributions across the rods, tubes around it, encompass the full range of stresses, that it has the same chemistry and that the material construction of these tubes are about the same, and that the weld materials are the same.

So that in terms of uncertainty, these

things are captured in the Oconee case, and the only variable that is really different from it and the other plants is the time and temperature.

In that case, seems to me like it would be a predictive model, because you know when Oconee went, and in ranking things relative to it on a time-temperature basis, you have captured perhaps the uncertainty, and it would be predictive in terms of when to expect these other plants to have the same problem Oconee had.

What is wrong with that view?

MR. HISER: Oh, I think that's a reasonable view, but given the uncertainty that exists in the model, if we say a particular plant is one EFPY away from Oconee, I wouldn't want to go back in a year and then expect to find cracking.

There may be incipient cracking at the present time. It may be that there are some local fabrication methods or something like that that would maybe push them out further in time.

I think the uncertainty really lies in --

DR. KRESS: What I had in mind there was not all the Oconee tubes cracked, just some of them. It was those that had the extreme ends of the uncertainty. Now you talk about another plant. You wouldn't expect maybe it to not crack within one or two years or whatever the prediction is, because it's not going to have the extreme ends. But what you can say, it's not going to crack before this time. That's the important part.

DR. WALLIS: I am not sure about that. How many cracked at Oconee?

MR. HISER: There were nine nozzles cracked, two --

DR. WALLIS: Okay, nine out of so many. Suppose it's a statistical thing with some probability. If it were one out of, now that tells you something. It's nine out of. So the chance of not getting one out of in some other one is not the same as the chance of not getting nine out of.

I would think someone would do some statistical analysis about that.

MR. STROSNIDER: This is Jack Strosnider. I would like to comment on this question, if I could.

I think if you try to look at this in terms of all the random variables that are involved in susceptibility or when cracking is going to occur, you've got a long list. You've got the time. You've got the temperature. You've got the microstructure. You've got some fabrication history. We don't know about -- that you don't know about in terms of how things might have been bent or what cleaning solvents might have been used, etcetera.

So you could come up with a long list of random variables that would have to go into the evaluation. Now I think the question that Dr. Kress was asking is could you assume that Oconee represents the spectrum, a spectrum of those.

I don't think we can necessarily make that assumption. Number one, we don't have the information to confirm it. But number two, when we look -- I think if you look back at the 97-01 experience where some microstructural data was available, there's a certain number of heats that were used at Oconee, but you don't know that you've got the worst heat. It certainly doesn't represent every heat material that's out there.

Just as an example, come back to the earlier question with regard to doing an analysis to understand the variability in terms of the uncertainty of this model. That's something we would all like to do, but in order to do that, you have to exactly the sort of data that I'm talking about, which --

DR. WALLIS: But when you've got a complex model like -- situation like this, you can make some sort of simplified statistical model.

MR. STROSNIDER: Right. But I think at this --

DR. WALLIS You can make some postulates. Then, it seems to me, you can get sort of the probability of one, two and three, based on that model, and you've got nine happening here. So that you cannot just -- Then your curve that we show would tell you something about the probability of nine occurring at these other plants.

We really want to know an estimate of the probability of one occurring in a plant. Seems to me, you could do that based on some gross guess of the kind of statistical --

DR. KRESS: Well, you have to make some guess about how representative --

DR. WALLIS: -- a distribution or one of those magical things.

DR. KRESS: It's like he said. You have to make some --

DR. WALLIS: But do it. Show us an analysis that predicts something and not just words.

MR. STROSNIDER: I would suggest you have to be very careful, because when you start trying to predict probabilities of things occurring like that, you are going to have to define the populations, the statistical populations; and I come back again to you need the data that we were talking about that we don't have in order to define those populations.

DR. WALLIS: But you have to do something.

MR. STROSNIDER; We have looked at things from a statistical point of view in terms of sampling, and I think we can talk about that when we get to it.

DR. WALLIS: So someone has done that?

MR. STROSNIDER: Yes, but it's not the level of detail that you are looking for, because as I said in my introductory remarks, we don't have the information to do that analysis.

Yes, you can make some assumptions, but how many assumptions are you willing to make? So at this point --

DR. WALLIS: Well, make the simplest assumptions to get started, and see what you come up with. And then explain it.

MR. STROSNIDER: Agreed. But at this point the assumption we are making is that there's uncertainty in the susceptibility ranking.

DR. WALLIS: Well, that's not an assumption. That's a given.

MR. HISER: One of the industry

recommendations in the report was that plants within 10 EFPY of Oconee Unit 3 should take some extra precautions, I guess, in doing their examinations. They should make sure they were extremely careful.

From the staff review of Generic Letter 97-01 modeling that was performed, Arkansas Nuclear-1, Unit 1, was at that point predicted to be more than 15 years away from -- based on susceptibility. Four years later --

DR. WALLIS: Away from what?

MR. HISER: I'm sorry?

DR. WALLIS: Away from what?

MR. HISER: Away from being susceptible to PWSCC.

DR. WALLIS: Well, they are all susceptible. You mean having cracks that go through?

MR. HISER: Actually, the model at that point was in comparison to DC Cook. So it was again in a relative ranking sense, Arkansas Unit 1 was 15 years away from having a susceptibility --

DR. WALLIS: The same kind as Oconee?

MR. HISER: Same conditions. Well, actually, the same as DC Cook Unit 3 at that point.

MR. HAMILTON: If I could comment -- John Hamilton from Energy Nuclear.

The statement is correct that Arkansas Nuclear 1 was ranked relative to DC Cook, to the benchmark of DC Cook under 97-01. When the current MRP rankings were based on just time and temperature and excluding the material factors gives -- moves ANO-1 into a position comparable to Oconee.

MR. HISER: Yes, the point we want to make is that modeling retrospectively is able to explain things, but in trying to use a model in a predictive manner in any sense, the 10 EFPY threshold would not be supported based on that experience. It may be in five years we come back and say, well, the model did an excellent job.

I guess the only point is we don't think 10 EFPY is the proper threshold to cut off additional attention.

DR. WALLIS: You have a very good initial model which enables you to interpret new data as it comes in. It may be that after a year you will get more or less confidence in that model. MR. HISER: Right. Absolutely.

Now the staff also had questions regarding the adequacy of visual examinations for detection of boron. As Larry pointed out, the observations at Oconee were that there were very small quantities of deposits. Less than one cubic inch is what has been quoted.

The staff concerns related to, first of all, the variability in the interference fits from plants to plant. I think we found that the drawing --

DR. WALLIS: Can I go back to that. Did they do tests of the ones that did not show boric acid deposits to show that, if there were big cracks, there would be necessarily boric acid deposits? I mean, did they do tests to show that the ones that did not have deposits were not cracked?

MR. HISER: No.

DR. WALLIS: Well, I would think you have to do that.

MR. HISER: At Oconee --

DR. WALLIS: Your whole hypothesis is that, if there's a crack, there's a leak, and there's a boric acid deposit, if it's a big enough crack.

MR. HISER: At Oconee they found nine leakers, Oconee Unit 3. They did ultrasonic examinations of those nine plus an additional nine, and found no additional cracks.

DR. WALLIS: No additional cracks in the other nine?

MR. HISER: Correct, in the other nine.

That's out of 69 total in the head. So they did volumetric examination of 18 --

DR. WALLIS: So it's a sample, and then you would have to look at some kind of statistical model to tell whether that was a good enough sample and all that sort of stuff.

MR. HISER: Right. Absolutely.

DR. WALLIS: But your hypothesis says that you can use the presence of boric acid crystals as a true indication of the kind of cracks you are worried about.

MR. HISER: That is the industry's --

DR. WALLIS: Somebody's hypothesis.

MR. HISER: Right, that's industry's assumption, and that's what the ASME code assumes at the present time.

MR. ROBINSON: Alan, just to add also that on Oconee-1 we looked at an additional eight nozzles for extent of condition, and of those eight that we looked at, we found similar conditions like we found on Unit 3, again just some minor craze cracking in nozzles that were not leaking.

So we looked at a sample on both Unit 1 and Unit 3. The extent of condition inspection showed only the minor craze type cracking.

DR. WALLIS: You would think there would have to be some which are on the point of leaking and have pretty big cracks. But you didn't find anything like that?

MR. ROBINSON: No, sir.

DR. WALLIS: There must be some in the intermediate stage, presumably. They have to go through that stage, don't they?

MR. ROBINSON: They have to go through the stage, but of the ones that we inspected, we didn't find any like that.

DR. WALLIS: So it's a big of a conundrum. You've got the ones that cracked and leaked and the ones that didn't crack much at all. There's nothing in between.

MR. ROBINSON: And that's the mystery of this thing. If you look at the two samples of the nozzles that are leaking and the ones that we have examined and are not leaking, they are like two entirely different populations.

You've got the severe cracking in the ones that do leak. You have minor craze cracking in the ones that aren't leaking.

DR. WALLIS: That's disconcerting, because it means there may be some cause which we don't know about which is causing some to crack much more than others.

MR. HISER: Can we clarify one thing? The leaking nozzles -- there were cracks found in all leaking nozzles.

MR. ROBINSON: This is true.

MR. HISER: Okay. In one nozzle at Oconee Unit 1, there was a part through-wall, OD initiated circumferential flaw. It's about 20 percent through-wall.

MR. ROBINSON: On Oconee-1 it was a crack that initiated in the weld that moved into the nozzle base material and traveled up to the annular area, and that crack was radial and totally axial. There was no -- I'm sorry, there was a small circ piece to the one. But Unit 2 we did find a small circ crack on Unit 2.

MR. HISER: Okay, Unit 2. So you could call that the intermediate step. Unit 2 did have a part through-wall circumferential crack.

Now back to the --

DR. KRESS: So are you saying 15 years would have been a better choice? Fifteen effective full power years?

MR. HISER: I think something more than ten. Again given the differences in the models, ten does not seem to be sufficient was our conclusion. In a few slides, the staff looks at the susceptibility rankings, and we have some conclusions on appropriate subpopulations to look at from the plants.

CHAIRMAN FORD: Just to -- As you go through this, these are the staff concerns arising out of industry MRP whatever the number was, 44.2.

MR. HISER: Right.

CHAIRMAN FORD: And the resolution of those concerns have to be resolved before the fall outages or before the fall/spring or two outages?

MR. STROSNIDER: This is Jack Strosnider. Let me see if I can respond to that.

If you look -- When we get into the information we are requesting in the generic letter, we talk about if a plant does not intend to perform inspections before a certain date, they need to provide a justification. The justification would have to address these sort of issues.

In fact, it's the industry's responsibility to respond to these questions and to provide the information necessary to support safe operation of the plant.

Now that doesn't mean that we aren't, you know, as the technical staff, trying to understand these things ourselves through our research activities, etcetera, but the whole process we are working through here is to get a communication out to the industry that says you need to provide your basis for when you are inspecting and what your technical justification is, and it needs to consider all these sort of issues.

CHAIRMAN FORD: Okay, I understand. Keep going.

MR. HISER: Okay. Now again, some of the problems with the small quantities of the deposits are the variability in the interference fit and how that may restrict deposits flowing from the crack up to the top of the vessel, and also the tightness of PWSCC cracks.

I think we had a quote earlier today of one gallon of leakage at Oconee over a 12-month period. So there is not much leakage from these things.

DR. WALLIS: One gallon a year?

MR. HISER: In a year. Yes, Oconee Unit 3 had cleaned the head 12 months earlier, then did a visual in a 12-month period. Now that assumed -- Well, that's what they found.

DR. WALLIS: One gallon a year? The

velocity up the crack is very, very low, isn't it? And yet we are told it carries boron up there. It's in solution, because it's vaporized.

Again, it will be useful to have someone explain an analysis of these things in terms of these sorts of numbers. I mean, is it a diffusion phenomenon, a flow phenomenon. What happens to the boron? Where do you expect to find it? What kind of concentrations?

Is someone going to present this sort of thing?

MR. HISER: We don't have information on that. I mean, again that's --

DR. WALLIS: Well, I mean if I've got something like this in a class of graduate students, I would say go away and do some homework; make some calculations about flow rates, rates of this, that and the other, come back with some answers tomorrow. Right? With the best that you know.

MR. STROSNIDER: If I might interject, that's basically what the purpose of the bulletin is, telling the industry to go off and get those answers.

DR. WALLIS: So wait and do all the paperwork and then someone sits down and does some thinking. Is that what happens?

MR. STROSNIDER: Well, we'll get into the work that we've been doing. As I mentioned earlier, Research brought contractors on board to start looking at this issue, and we are trying to do that.

DR. WALLIS: You have so much inertia to get going.

MR. STROSNIDER: I'm sorry, I didn't hear you.

DR. WALLIS: You seem to have so much inertia to get going on something.

MR. STROSNIDER: Maybe we'll address more of this as we get through the presentation.

MR. HISER: So the staff has -- Regarding the visual inspection, staff really has two concerns. One is: Is there sufficient deposit that is available on the head for detection; and secondly, what are the difficulties involved in identifying the leakage or the deposits that one sees and identifying whether they came from vessel head penetration nozzles or from other sources, as indicated here.

Now one point that, I guess, I would like to make regarding insulation, just to make sure that we have a clear understanding of the situation regarding insulation -- This is a similar schematic to what Larry showed this morning.

The insulation at, I guess, all of the B&W is in a horizontal position like this, such that the head surface is readily available for inspection. Many of the plants, I think, from Westinghouse and Combustion Engineering, the insulation is contoured to the head and, in some cases, offset by several inches, providing a gap through which one could do some sort of an inspection.

In other cases, it is either directly lying on top of the head or is even adhered to the head. So the difficulties in doing the visual inspections in those cases are -- The problems are clear and were not addressed at all in the industry report.

As we discussed earlier today, the remaining ligament margins that the industry cited in the report did not include a clear discussion of time margin and crack growth rate. Their response to our REI questions did provide some information on that.

Sort of sum up the staff concerns, we are concerned that a plant -- or a nozzle could reach a critical crack size before one is able to detect leakage. With the visual examinations, these are on a periodic basis, depending on the cycle length for the plants.

There is no continuous monitoring that could provide any intermediate assurance that there was no leakage occurring. And in addition, the inspection under insulation needs to be addressed.

Now the report itself did not provide too much discussion on postulated accident analysis and risk insights. The staff perspective will come from Mark Reinhart, and the staff again is really concerned with how -- this issue regarding compliance with the regulatory requirements in this case.

(Slide change)

MR. HISER: Now regarding the regulatory requirements, the staff has gone through the regulations and the next two slides provides some detail on areas that we think there would be questions.

10 CFR 50.55a references Section XI of the ASME Boiler and Pressure Vessel Code, and in particular the code does not permit through-wall cracking of pressure boundary components.

Technical specifications for each plant also do not permit through-wall leakage. Clearly, if we have boric acid deposits, those that are not attributable to flange connections or things like that, then there would be questions about compliance with these.

The General Design Criteria in Appendix A -- you know, we have particular criteria that we think apply in this case, if not in a regulatory sense, then at least in a philosophical sense: That one should not have -- or one should minimize probability of rapidly propagating fracture of the reactor coolant pressure boundary, and the reactor coolant pressure boundary should have extremely low probability of abnormal leakage.

(Slide change)

MR. HISER: Flipping to Slide 10, from Appendix B we have some of the criterion there that we think apply. One is control of special processes, which would include things like non-destructive testing, that they should be accomplished or controlled and accomplished by qualified personnel using qualified procedures in accordance with codes, standards, specifications, criteria and other special requirements.

In addition, activities affecting quality, from Criterion V, should be prescribed by documented instructions, procedures or drawings, including appropriate acceptance criteria.

Then Criterion XVI related to corrective actions. Conditions adverse to quality should be promptly identified and corrected with a determination of the cause of condition and implementation of corrective action to preclude repetition of the problem. We think this applies not only to plant specific items requiring corrective action, but also from incidences at other plants. So we think that would apply in this case.

So these are the regulatory requirements than we think apply in this case.

(Slide change)

MR. HISER: Now looking at the staff assessment of the situation, looking at the susceptibility rankings that were provided by the MRP, the staff has identified subpopulations of plants based o their susceptibility.

There are four specific populations. One is those plants that have identified cracking at the present time. In particular, that would include the three Oconee units, along with Arkansas Nuclear 1. That's sort of a special subpopulation.

(Slide change)

MR. HISER: If we look at the overall susceptibility rankings, an inferior version of Larry's slide from this morning without the pretty colors -- If we look at the rankings in an overall sense, we identified, if you will, a natural break in the data at around 4 EFPY.

What we would submit is that the plants that are less than 4 EFPY away from Oconee Unit 3 define a subpopulation.

DR. WALLIS: These are the cold plants and the hot plants?

MR. HISER: These would be probably, I guess Larry would say, the hot plants that have been operating for a long time.

DR. WALLIS: Well, I know, but the break is between the cold and the hot.

MR. HISER: No. This is --

DR. WALLIS: Different scale?

MR. HISER: Yes. This is the fine scale.

DR. WALLIS: Oh, I'm sorry. Excuse me. Yes, you are right.

MR. HISER: So this is the overall rankings. So if we look at this point down here at about 4 EFPY, look at plants below that as being a subpopulation. Then look at plants at about 30 EFPY, so between 4 and 30 EFPY is a separate population. We would have those three subpopulations, and then really this is a balance of plants.

DR. WALLIS: Now if your uncertainties are the order of 2 EFPY, that would sort of mean that your distinction is no longer -- in the fine scale is no longer so significant. We don't know the uncertainties. They haven't been quantified for us in terms of EFPY.

MR. HISER: That's correct, but I think in the way that we choose -- that we have proposed to use these subpopulations, I think that we are just using it as a guide for information collection. We are not proposing any actions at plants at this point. We are just looking to gather information so that we can assess the magnitude of the problem at this point.

DR. WALLIS: I guess if you -- I'm sorry. If you knew something about what you think your uncertainty is, this would tell you about how surprised you are if you find a crack at, say, Number 6 or 3.

MR. HISER: Right.

DR. WALLIS: So you do need to get your state of knowledge now in order in order to interpret any new data you get.

DR. BONACA: Before you move on, on slide Number 11, you had plants with low susceptibility, and you say that PWSCC not likely through current license period. Do you mean the 40 years of life?

MR. HISER: For the first 40 years. Yes. And those would be plants that are more than 30 EFPY.

DR. BONACA: So you have that kind of level of confidence in your predicting capability?

MR. HISER: We have a relative confidence at this point. The plants that are in the first three subpopulations, the first plants have demonstrated a problem. The second plants, second group of plants, we expect that it's likely to occur in the near term.

For the plants that are between 4 and 30 EFPY with moderate susceptibility, we don't think it's likely to occur in the near term, but it could occur. We would not be shocked based on uncertainties in the modeling.

DR. BONACA: Sure, I understand.

MR. HISER: The last group of plants clearly has lower susceptibility than the first group. This represents about a third of the PWRs. Any actions that might be required there clearly would be able to key off of findings from the first three groupings.

DR. BONACA: Yes. I was just focusing on the statement "current license period." That's a long time.

MR. HISER: Right.

MR. STROSNIDER: This is Jack Strosnider. If I could interject just for a second a thought.

The way we are using these rankings is sort of a graded approach to the information that we are requesting. All right? So I think you will see some of that come together when we actually get into the information request, and how we use these different categories to say here's what we are asking licensees to provide us.

DR. BONACA: I understand, and I agree with the approach. When I read the words that you use there, it expressed some level of confidence that I'm not sure the current -- you know.

MR. STROSNIDER; And I don't think we want to express any level of confidence other than here's a graded approach to collecting information so that we can decide then what additional actions might be appropriate.

DR. WALLIS: However, we were told that you wouldn't be shocked if you found them, but you would be shocked if you found cracks in the bottom layer there, the 24 plants total.

MR. STROSNIDER: I think we would be very shocked.

DR. WALLIS: It would force you to reevaluate all your assumptions.

MR. STROSNIDER: Absolutely.

MR. HISER: I think that would be a very surprising occurrence, given that many of the plants are 100+ EFPY away.

As Jack mentioned, what we are looking to do within the bulletin is to verify compliance with the regulatory requirements, and we think this is best achieved through qualified examinations. On the next page, I'll go over what we think qualified examinations are.

This is a graded approach that is keyed on that the subpopulation at each plant is listed within. In this case, we think examination of 100 percent of the vessel head penetration nozzles is appropriate.

There was some discussion about the CRDM nozzles. There also are thermocouple nozzles. I think there are vent pipes in some of the heads. There are other penetration nozzles in the heads that are fabricated from similar materials and would be expected to have similar cracking histories.

Why do we think 100 percent of the nozzles is pertinent is that, from looking at the statistics of the situation, there really is no -- very little benefit to doing a small inspection, limited inspection of nozzles.

If you look at the leakage history of the nozzles, it's not even possible to define a certain part of the head as not having exhibited any leakage. So we think all nozzles are created equal and deserve equal attention in this case.

MR. STROSNIDER: Al, if I could interrupt you for just a second. There seemed to be some interest earlier in the statistical evaluation. Lee Abramson from the Office of Research is here. He assisted us in that evaluation. If you are interested in hearing about that, I would suggest maybe Lee could answer any questions you have.

DR. WALLIS: Maybe there's some data in curves. We could just be given the papers so we could look at them.

MR. STROSNIDER: Well, there's actually -- We have a write-up with regard to some of the analysis, the sampling analysis that he put together. We could provide that.

DR. WALLIS: I think it would be more efficient than trying to do it orally.

MR. STROSNIDER: Okay. We can do it that

way.

(Slide change)

MR. HISER: Now regarding qualification of the examination methods, the staff has identified three --

DR. WALLIS: I'm sorry. Would you mind just going back to 12 for just a quick question. I just want to make sure.

(Slide change)

DR. WALLIS: The triangles -- This is really the cumulative number of units, isn't it, on the top?

MR. HISER: Yes.

DR. WALLIS: Cumulative number of units. So the three triangles down in the lefthand side there, that's the Oconee plants, and presumably there's another triangle somewhere farther up which is the ANO. Yes?

MR. HISER: Right. I'm not sure. It's one of these points. I know the industry -- We were told last week that this evaluation was their initial cut at things. They have gone back and have sharpened the pencil a little bit, and there's a little bit of shifting of some of the units.

DR. WALLIS: So there is a -- My eyesight, I can't tell the difference between some of your symbols there. But there is one associated with later at the top righthand corner, the far righthand one, later.

Now I can't read it very well, but the one that's furthest to the left on that graph -- isn't there one of those points at one year, effective power year, one of those things that's not supposed to be inspected yet? Is my eyes off?

MR. HISER: I would defer to Larry, if you have your color slide?

DR. WALLIS: Well, regardless of the specific question --

MR. MATTHEWS: There were two plants in under ten years that would not have had a refueling outage by -- I am not sure if that fourth dot on the graph is one of them or not.

DR. WALLIS: But that's how this graph would be used, is to say, well, hey, Mr. Plant, fuzzy on the righthand side, why aren't you inspecting before '02 or that's the reasoning behind this?

MR. HISER: Yes. I think our bulletin requests that they provide the basis for why they do not need to do inspection.

I think we're done with the susceptibility rankings.

(Slide change)

MR. HISER: Okay. If we look at the examination methods, the staff has again provided a graded approach, if you will. For those plants with moderate susceptibility, we think a VT-2 visual examination that is qualified is a reasonable approach.

The qualification that we think is appropriate in this case is one that demonstrates the capability of detecting small amounts of boric acid deposits and the ability to discriminate deposits from VHP, vessel head penetration, nozzles and other sources. Presumably, if you can't say it's from another source, then you have to assume it's from one of these penetration nozzles.

Again, that would be appropriate for the moderate susceptibility plants, those from 4 to 30 EFPY of Oconee, and that would represent 31 plants total, at least from the initial susceptibility rankings.

Now the next approach would be a plant-specific visual examination qualification. In this case, on a plant-specific basis we think that a demonstration would be required to demonstrate that

VHP nozzle cracks will lead to deposits on the head, and that includes consideration of interference fits and other plant-specific as-built considerations.

DR. WALLIS: So the real question is whether you can detect enough boric acid in time before there is a circumferential crack which is growing sufficiently to cause you problems for all possible situations of interference at some whatever.

MR. HISER: That's exactly right.

DR. WALLIS: And we haven't seen any quantitative analysis of that. It's just someone's hope that that's the case?

MR. HISER: We would expect some sort of a demonstration that that is the case.

DR. WALLIS: I think you need that.

MR. HISER: If it cannot be demonstrated, then we think that visual examination is not appropriate. You have to be able to demonstrate that.

In addition, again the two-step process. Step 1 is, if boric acid leaks out, it will come to the surface. The second part is that, if it's there, that I'm able to find it. So I must be able to reliably detect it,and also identify the source of the leakage. That would include considerations of things such as insulation, preexisting deposits or other impediments to the visual examination.

DR. WALLIS: We heard about lithium. Where does the lithium go when it comes out?

MR. HISER: I haven't heard of detection of lithium.

DR. WALLIS: Where does it go? You only find boron on the outside. You don't find any lithium?

MR. HISER: I'm not sure what was found at Oconee, if it was only boron or if they did any --

DR. WALLIS: Well, is this lithium borate or what is this stuff that you are seeing?

MR. FYFITCH: Steve Fyfitch, Framatone.

The boric acid concentration in the reactor is anywhere from about 1800 ppm down to zero as you go through the cycle. The lithium concentration is 2 ppm down to almost zero.

So the amount of lithium in the boron that you are finding on the head is so minuscule, it's hard to detect it.

DR. WALLIS: But it's enough to make the environment in the crack region possibly alkaline.

MR. FYFITCH: If it were to concentrate, yes.

MR. HACKETT: This is Ed Hackett. I think

I would add a further comment to that. Dr. Sieber mentioned earlier, too, that the species that I think you would be concerned about is lithium hydroxide, and it's a much more volatile situation than the boric acid.

So probably, in addition to the concentrations, that would be another reason why you are not seeing any deposit or anything like that.

DR. BONACA: I would like to ask a question then. Just Oconee performed an inspection the previous cycle. Right? And there was no indication of leakage. Now they performed this inspection and found some circumferential cracks that extend almost half the circumference. Some were less.

Either from a detectability standpoint or from a crack growth rate standpoint, what does it tell us? I mean, I hear projections now that it will take many years before these cracks can extend beyond that. Is there someplace where you are going to address these issues or talk about them?

MR. HISER: Not within the context of the bulletin. What I can --

DR. BONACA: Did I explain what my trouble is there?

MR. HISER: My understanding is that

Oconee Unit 3 at its previous outage had completed cleaning of the head, and at that point they had a clean head that they were able to do effective detection of the boric acid. One year later they detected boric acid.

DR. BONACA: So it may have been that there was some leakage, but it was not identified.

MR. HISER: The one comment that I heard--

MR. ROBINSON: This is Mike Robinson, again from Duke Energy, and I'll try to address your question; because we asked ourselves the same question.

We had the Unit 1 outage in November of last year, and that's when we first found the first signs of leakage on top of the head. Unit 3 had been down for its refuel earlier than Unit 1. We had to bring Unit 3 offline in February for a maintenance outage.

We started back in 1993 and in '94 cutting the holes in the service structure and doing head cleanings during each refuel outage to get the heads to a good condition to where we could do good visual inspections.

When we did the inspection on Oconee 1 and found the leak -- again, that was prior to Oconee 3 coming down. The fellow who does our inspections, obviously, became a whole lot more sensitized to what to look for.

Prior to finding leaks on Oconee 1, the expectation was, if you have a leak through one of these nozzles, you're going to find pounds of boron on top of the head, much like what we saw down at VC Summer.

So the mindset was, if you are looking for leakage, you would expect to see something fairly large, and again it was just a total shift for us once we did see something that looked suspicious to now identify that as true leakage.

We suspect on Oconee 3 that we had had some leakage in prior years. We suspect, although you can't prove, but we think we had some cracks at the point of actually going through-wall to where we did see the leak once we came down for the forced maintenance outage.

DR. BONACA: Okay. This explains to me a little bit why, and there may have been some leakage before. However, what you are telling me gives me concern about how much it will take, how long it will take for the future plants to be able to identify. I mean, what you are telling me is that you need significant cleaning of the head before you can really be sure that you can see a leakage.

MR. ROBINSON: A real key is to have a good clean head.

DR. BONACA: That's right, and many of these plants do not have.

DR. WALLIS: Well, it tells us something else. The real leak started several years ago. Then the zero hour for your graph certainly change.

MR. HISER: That may be true.

MR. ROSEN: What is the expectation here? Do we think the nine cracks that we found at Oconee are all the cracks that's going to happen to that head or is it eventually are they all going to crack?

MR. HISER: I don't think the staff believes they are the only nine that would ever develop in that head. Given the distribution of the phenomenon, you know, we are some point early in the curve. I would expect ultimately, if you run the plant long enough, every one will crack.

MR. ROBINSON: Again, we think that PWSCC is a like a cancer. Once it starts, it's going to continue to grow. We know we have susceptible material. We know we've got the temperatures, all the kind of things that you need for this phenomena to be there.

That's one of the reasons we have made the decision to replace the heads at Oconee.

DR. BONACA: Thank you.

MR. HAMILTON: John Hamilton with Energy Nuclear. I might comment on the ANO experience in the outage previous to this spring. There was a visual inspection, and there was some boric acid in the vicinity of the nozzle that we found leaking this spring.

In the previous outage that boric acid was examined, and we've attempted to determine where it was coming from. The determination at that time was that it was not a control rod nozzle leak. A photographic record was made, and in the outage in the spring we again examined it using a robotic video camera, and concluded that it was a control rod nozzle leak at that time.

What we have now done is that we cleaned the head thoroughly after the outage and made another baseline video record so that, any future outage, we'll be able to easily determine what the situation is.

DR. BONACA: But still, I mean, for this 20-odd plants that will inspect their head over the next nine months, what I understand is it there will be difficult to characterize a small leakage, because the heads are now clean.

I'm trying to understand, because if you look at it, you cannot characterize it. You cannot make any conclusions. Then the best you can do is to commit to another inspection two years from now, maybe year and a half, whatever the cycle length is, which puts off quite a bit the time which they are detectable.

MR. STROSNIDER: This is Jack Strosnider. I think, when you see -- when we get to how we have constructed the information request, you will see that we are trying to address that issue. If licensee cannot perform a qualified or plant-specific qualified visual examination, then they need to provide a basis why they are not doing a volumetric examination.

DR. BONACA: Okay.

MR. STROSNIDER: I think when we get through -- when you see how we've structured that, we have tried to address that issue, because it's not clear that waiting outage after outage to collect that kind of data is acceptable.

MR. MATTHEWS; This is Larry Matthews again. In some of the slides I showed, many of these plants don't have anywhere near the degree of masking boric acid sitting on their heads that the B&W units do, because they don't have those flanged CRDMs. They have Conoseal or canopy seal welds that seal those up pretty good.

Now some plants have canopy seal weld leaks occasionally, too, but those get cleaned up. So like the Robinson picture I showed, that's a pretty clean look, and Salem was, too.

So, you know, it's not like every plant is sitting here with half a ton of boron sitting up there, and you're trying to pick a teaspoon out. It's not that way at all the plants, certainly, and I think the B&W plants have been working on their issue for a number of years.

MR. STROSNIDER: Just to follow up on that thought for a second, I would just point out that recognize that the bulletin is addressed to all the PWR licensees. This is a plant-specific issue when you start asking what is the condition of the head.

So, really, it's probably not possible to come up with a generic solution to that. You have to go out to each licensee, and they have to assess the condition of their head and whether they can effectively perform this sort of examination. So that's another reason that we are looking at a bulletin.

MR. HISER: In terms of a qualified volumetric examination, this would be one that has a demonstrated capability to reliably detect cracking on the outside diameter of vessel head penetration nozzles.

In this case, we think it's appropriate for plants that have identified cracking. As I think Mike Robinson said, the cancer is there. We just want to determine how far it's spread. At this point we think that's four units altogether.

We think this would also be appropriate as a default if the visual examination cannot be qualified, either the VT2 visual or the plant-specific visual, and clearly would be applicable to any plant that finds leakage, because then, again, we know they have the disease.

(Slide change)

MR. HISER: IN terms of the proposed information request, the request is to licensees, and we ask them to provide within 30 days of the issue date five particular items.

Actually, Item 1 is pertinent to all licensees. Items 2, 3 and 4 are to the various subpopulations, and then Item 5 is also pertinent to all licensees.

Item 1 is for each plant to provide its plant-specific susceptibility ranking, and including all of the data used to determine that ranking, and also to provide a description of the vessel head penetration nozzles, including the number, the type and materials used to fabricate them.

This will provide us with a background on what is in each plant in terms of the nozzles and where they lie within the industry's susceptibility histogram.

Now for plants that have identified leakage or cracking in their nozzles -- and that again would be the three Oconee units and Arkansas Nuclear Unit 1 -- we ask them four specific questions.

One is to describe the extent of nozzle leakage and cracking that they have identified to date; to describe the inspections and other corrective actions that they have taken, repairs and other corrective actions.

We ask them to discuss their plans and schedule for future inspections, in particular, the type of inspection, the scope, qualification requirements and acceptance criteria.

Regarding how those planned inspections can be used to demonstrate compliance with regulatory requirements: If the inspection plans do not include inspections before the end of this year, we ask them to provide the basis for concluding that the regulatory requirements will continue to be met until the inspection is performed.

If the inspection plans do not include volumetric examination, which the staff had concluded earlier is appropriate, of all of their vessel head penetration nozzles, then we ask them to provide the basis for concluding that the regulatory requirements will continue to be satisfied.

(Slide change)

MR. HISER: So that's the information request for plants who have demonstrated cracking. For those that the staff identified as high susceptibility -- in other words, those plants within 4 EFPY of Oconee Unit 3 -- as ask them to describe the vessel head penetration nozzle inspections that have been performed in the last five years so that we have a background on the types of inspections that they have been able to perform based on things such as insulation and preexisting boric acid deposits.

A second question is for them to provide the plans and schedule for future inspections.

Item 3 relates to how their planned inspections will meet the regulatory requirements. if the inspection plans do not include any inspection prior to the end of 2001, then we ask them to provide the basis for concluding that they will continue to meet the regulatory requirements until they perform their inspection; and if their inspection includes only visual examinations, to discuss corrective actions, including alternate examination methods such as volumetric, if leakage is detected.

CHAIRMAN FORD: On Item c(1), I'm assuming that the scenario is that they have found a boric acid deposit at the top of that tube. If the regulatory requirement is that they cannot go through the pressure boundary, which I am assuming would be the circumferential crack going all the way through, a lot is going to depend on how they reply to you for the disposition curve or the crack propagation item.

MR. HISER: c(1) assumes that they do not plan to do any inspection in the short term, during, say, the fall outage season.

CHAIRMAN FORD: Okay. But it's still the same thing. Provide basis for concluding the regulatory requirements, i.e., they won't have a through-wall crack, will continue to met until the inspections are performed, i.e., some ISI period.

MR. HISER: Right.

CHAIRMAN FORD: In the future. That's going to depend on how satisfied you are with the velocity stress intensity disposition curve. Yes? So are you going to have before the event your approved disposition curve, what you will accept? Would you accept a disposition curve based purely on crack growth rates in the primary coolant?

MR. STROSNIDER: Al, let me interject. This is Jack Strosnider, because I was going to address this later in my concluding remarks.

We are asking for these assessments, basically, to come in from the industry, and one of the important things is going to be that we have some continuing dialogue as they are developing what these responses are going to look like; because it's not going to serve anybody well if we come in in the September time frame or so and we have a disagreement on whether it's an appropriate answer.

So -- But recognize there is a real challenge here in terms of, if you want to tie it to crack growth data, you know, what's going to be able to be done by that time. But the best answer I can give is that I think we need to have this continuing dialogue.

We have had good communications with the industry, and that needs to continue. But we do recognize that we are taking on an issue where in the September time frame we are going to get these responses and have to determine whether we think they are adequate or not.

DR. WALLIS: Well, can we be more specific? Are you going to require that they analyze the effect of concentration of lithium hydroxide in the space, possible effects of it, or that they make an analysis, an assessment of it?

MR. STROSNIDER: I would suggest that, if their justification -- If they are going to provide a justification for some later date of examination than what is in this request, then they are going to have -- and if it includes some assumed crack growth rates, that we are gong to have to have discussions on the technical basis for those growth rates.

DR. WALLIS: Well, discussions -- I mean, if they come back with an assessment which completely ignores, in effect, which we've questioned at this meeting, are you going to accept it?

MR. STROSNIDER: It could come back

perhaps and assume some very high growth rates.

DR. WALLIS: Assume? I mean --

MR. STROSNIDER: I think the answer to your question is we expect them to address those types of issues and providing a credible technical basis. Yes, they need to understand the environment and the growth rate, if that's what they are going to rely on.

DR. WALLIS: Well, I think you ought to come back with the technical questions to which you want answers and not leave it all up to some kind of dialogue. You ought to specify we want these technical questions answered. -- just wait for you to make an assessment and see whether or not you want to raise those questions.

MR. STROSNIDER: And in fact, we have provided the industry with a list of technical questions on several different previous occasions. Those are already documented, and it includes the kind of things you are talking about.

DR. WALLIS: Thank you.

(Slide change)

MR. HISER: For the plants with moderate susceptibility, those with susceptibility rankings from 4 to 30 EFPY of Oconee Unit 3, we ask them to discuss their plans and schedule for future inspections. Question b. is that, if inspection plans do not include a visual examination at the next scheduled refueling outage, to provide the basis for concluding that the regulatory requirements will continue to be met until they perform the inspections.

Then the last item on this page is, I guess, identified as 5 in the draft bulletin. For plants with refueling or scheduled maintenance outages, within 30 days after restart we ask them to describe the extent of nozzle leakage and cracking that they have identified and, Item b. there, if the inspections, repairs and corrective actions are different from those that they provided to us previously, we will ask them to describe what they actually did.

DR. BONACA: For plants with the low susceptibility, you have no requirement at all?

MR. HISER: They would fall under Item 5 at this point.

DR. BONACA: Item 5?

MR. HISER: Again, the bulletin is a short term, Phase I, if you will, of trying to gather information from those plants. We wouldn't really expect to find anything.

DR. BONACA: Last bullet on page 17?

MR. HISER: Yes. This is Item 5. I'm sorry, they should have been numbered instead of with bullets.

DR. BONACA: So everybody has to answer that question?

MR. HISER: Right, for the last one. That is the proposed information request.

(Slide change)

MR. HISER: In terms of the proposed required responses, this is what licensees must provide us. The other is a request, in all honestly.

Within 30 days of the date of the bulletin, we ask them to submit a written response indicating whether they will submit the requested information from the three previous slides, and secondly, whether the requested information will be submitted within the requested time period.

Now both the requested information and the required responses are both 30 days. This could be one submittal. Could be two submittals. If they were to provide us for Item 2 here that they will not meet the requested time period, then clearly, that would be a second response.

For addressees who choose not to submit the requested information or are unable to satisfy the requested completion date, they must describe in their response any alternative course of action that they propose to take, including the basis for the acceptability of the proposed alternative course of action.

So that would be the required response.

CHAIRMAN FORD: Allen, we've got exactly one hour left. I would like to put aside a quarter of an hour anyway at the end of the talk. It's quarter past one. Just so that we have some general comments from the subcommittee and, more importantly, give you advice as to what is going to happen tomorrow.

Bearing that, we've got three more talks, and I could leave it up to you to decide. You've heard some of the comments that went on this morning, and they are cut and paste or whatever it is to individual contributions to address those concerns. That would be really helpful. But I want to leave a quarter of an hour aside for any general questions.

MR. MARSH: We'll prioritize the presentations for you.

CHAIRMAN FORD: I suppose sub voce that we had better keep quiet.

MR. LEITCH: Just one question regarding the Oconee units. From reading this, it appears as though you are not requiring anything special of Oconee as far as a mid-cycle shutdown to take a look at these.

In other words, I would expect that the other CRDMs at Oconee are perhaps the highest susceptibility areas that we have, because we don't really understand exactly why some of them have cracked and some of them haven't cracked.

So is it correct that we are just allowing Oconee to operate on a normal refueling cycle?

MR. HISER: The bulletin that we propose, again, is step 1, just trying to gather information. Once we have input on what the licensee's plan and also what other additional data we would get from them, we would determine the need for additional regulatory action.

At this point, we are just in the information collection phase.

MR. LEITCH: Asking them what their plan is?

MR. HISER: Right. And again, with the proposed publication date of August 1, that, hopefully, would provide us with information by September 1. So we would be able to proceed at that point, once we have analyzed the submittals.

MR. STROSNIDER: This is Jack Strosnider. I wanted to point out, if I understood the question, if you look at the information request for plants that have identified cracking, we are asking them to provide a basis. If they are not inspecting before the end of 2001, they have to provide a basis for doing that, and similarly if they are not doing a volumetric examination.

So I think that Oconee would fall into that case, and they would have to provide a justification why they are not going to take those kind of actions.

By the way, I do think Oconee, the unit with the circ cracks is shutting down this fall, and I think that would have been a shorter operating cycle than normal anyway, because the last shutdown was just this past spring.

MR. HISER: Okay, thanks.

MR. REINHART: I am Mark Reinhart, the Acting Chief of the NRR Probabilistic Safety Assessment Branch, and I'm going to talk about the risk perspective.

(Slide change)

MR. REINHART: So when you look at this next slide, it really should say developing risk perspective, gathering what we know now. We are looking at a situation where we have the circumferential crack CRDM, and we are saying one scenario could be a rod ejection. One scenario could be a LOCA.

The rod ejection would be reactivity concerns. We talked about that this morning, and I think our expectation is that most plants operate with the rods out. So we are not so much concerned other than maybe in the collateral damage arena.

DR. BONACA: Just a comment on this morning. I mean, because they are running with the rods out, you know --

MR. REINHART: Right. During the start-up.

DR. BONACA: -- effect of the SCRAM maybe equivalent of the rod ejection from zero power, which is the most severe. Then it is analyzed, always separation from the LOCA. You have to look at the two combined events.

MR. REINHART: Yes, absolutely.

DR. BONACA; It makes it a very complicated scenario.

MR. REINHART: It would. It definitely would. The LOCA we put in the medium category, trying to mix apples and apples. In IPE guidance, a 2 to 6 inch break would be a medium LOCA. So that's why we considered that.

Both of these are analyzed events, but as we've brought out all morning and afternoon, there are a lot of significant uncertainties. So we are trying to gather information as we go and not lock ourselves in, but be ready to address those uncertainties when we can.

We are looking at various analyses and scenarios and struggling to see which fit, which don't fit, under which circumstance.

Collateral damage is one of our concerns. What will happen if a CRDM ejects? What type of internal, external damage would it cause? What about nearby control rod drive mechanisms? We don't know, but we want to try to understand that better.

Another concern is for plants that have blanket information on the head, the CRDM ejection, the medium LOCA, blowing that insulation, where would it go? Would it get in the sump or would it block recirculation? Injection and recirculation are key vulnerabilities in the medium break LOCA category.

So what we did, we said we are going to just see what we can say at this time, assuming --

we'll take about a medium break LOCA, and we just take our core damage frequency to the simplest form. W e have an initiating event frequency, and we have a condition of core damage probability, and we use the IPE data we have. For that initiating event frequency, we need to know a lot before we can really say much about it.

We talked about the chemistry, the materials, what mechanisms are involved, what are the synergisms, crack initiation, crack propagation, probability of rupture. All that needs to come together to really say what is the initiating event frequency.

So we said what can we say? Let's go to our basic equation, set that initiating event frequency equal to one. We will assume we have it. What does that give us in condition of core damage probability?

So if we looked at our IPE results, we had a spread. Most of them came into the 10^{-2}, 10^{3} range. The highest outlier was 4.7 times 10^{-2}, and the lower is categorized as less than 10^{-4}. So there's a spread, but most of them fall in that 10^{-2}, 10^{-3} range.

DR. BONACA: But those results was for a medium LOCA, right?

MR. REINHART: I beg your pardon?

DR. BONACA: That was based on a medium LOCA.

MR. REINHART: Yes. Assuming we have an initiating event frequency of 1 for a medium break LOCA.

DR. BONACA: That's right. And so there is no consideration of possible damage tied to the rod ejection.

MR. REINHART: We are not looking at collateral damage there. We are not looking at operator action recovering there at this point.

DR. BONACA: That's a big --

MR. REINHART: Yes. It is part of the uncertainty. We expect the operator is going to be able to do a lot to mitigate this accident. We expect that there might be some collateral damage that might make it very difficult.

DR. BONACA: You mean the old -- the FSAR shows significant fuel damage for the zero ejection accident. So I just --

MR. REINHART: I beg your pardon?

DR. BONACA: All the FSARs or the neutronic analysis show some degree of fuel damage for rod ejection from zero power. I think that that's a potential candidate here that may bring that into the -2 or 3 to a much higher number.

MR. MARSH: Well, but the damage that is caused by the core -- caused to the core from the reactivity transient is not the same criteria that you look at in terms of dose rates and things for LOCA purposes.

You could get damage from reactivity transients, but the acceptance criteria for a LOCA is a different -- Now you're looking at damage caused by melting, not damage caused by reactivity.
In other words, that adds to the dose rate inside of containment but not due to off-site dose or things of that sort.

So you do accept some fuel damage.

DR. BONACA: If you have some center line melting or if you have some clad failure. I mean, it just happens. If it's there and if you have IE=1 and you have some fuel damage in -- That doesn't seem right.

MR. ROSEN: I don't think, Mark, that the presentation here showing an assumed initiating event frequency of 1 is very useful. I would prefer you just left that out and just talked about the conditional core damage probability, because we know it's not 1. We are not going to always have these things.

MR. REINHART: I agree, but by definition to get conditional core damage probability, that's the condition.

MR. ROSEN: Well, perhaps, but people can misunderstand that.

MR. REINHART: I very well understand that.

MR. ROSEN: And in that sense, I don't think it's very useful.

DR. WALLIS: It seems very strange. Did you deduce it from the CDF? I thought your CCDP was a separate calculation. Then you multiplied by the IE(f).

MR. REINHART: You can take your condition of core damage probability, and then you multiply it by initiating event frequency to get your core damage frequency.

DR. WALLIS: But assuming it is one, then you've got 10^2 and you've got 100 reactors. That's not acceptable.

MR. MARSH: It's only meant to show in the relative sense what the mitigation systems are in terms of their strength.

DR. WALLIS: It's not very useful, though, is it?

MR. REINHART: Well, it is useful in the sense that we can home in on areas we need to look at, and we talked about we need to look at injection. We need to look at recirculation.

DR. BONACA: What they are saying: Given that, you have a break.

MR. REINHART: Right.

DR. BONACA: But the comment I am making: Given that you have a break, and they are not contending that the way you are dealing with, you know, if you have another event such as rod ejection that may give you fuel damage -- I'm not saying you will have it, but I'm saying you have to look at it, because I think it's credible -- then the number E-2 to E-3 is one.

You have already a fuel damage there, and now if you had a hole in the system, you are going to have loss of coolant with fission product through it. I mean, in containment.

MR. REINHART: So you're postulating the worst case scenario of (a) you have the rod ejection from zero power giving you fuel damage.

DR. BONACA: Yes, and I'm not saying it is going to happen. I think, however, that the dynamic effects of it, given that you have all the rods out, may be that you are dropping the rods in the core, and one is stuck out. This is not purely a stuck rod evaluation for a margin evaluation. It is a dynamic effect.

If that is the case, you will have some fuel damage, and then you don't have to wait for a LOCA to cause you -- You already have it. So --

MR. MARSH: We are not trying to imply that this is the core damage frequency. That's not what this is.

DR. BONACA: No, this is only to say you have to look at it. You have to look at it.

MR. STROSNIDER: This is Jack Strosnider. I would really like to comment on this use of the conditional core damage frequency. All right? And I would like to put it in this context.

If you look at the situation the NRC is in right now, I would put it in the context of decision making under uncertainty, and you have to make a decision when you've got a lot of uncertainties involved here, and you have to make a decision about what the appropriate regulatory action is.

One thing that might help to inform that decision is to understand the consequences of the event, should it occur. All right. So let's look at the conditional failure probability.

Let's assume that the event actually happens, and you look at the numbers here. These numbers tell you that you need to provide some increased attention on this. This is part of our basis for going the route of the bulletin and taking the action we are taking.

If these numbers were several orders of magnitude lower for this particular event, you might reach a different conclusion about your willingness to accept the uncertainties that are involved. Right? But when we look at these numbers, we conclude, no, there's the uncertainties associated with the potential for this event occurring.

When I look at the consequences of it, I need to better understand them, and I need to ask the industry to take some action to provide that sort of information, and that's what drives us to the bulletin.

DR. BONACA: Sure. My only problem was the numbers may be even higher.

DR. WALLIS: Well, you have to do something. If you are going to use numbers like E to the minus two, that something might be draconian.

MR. STROSNIDER: I'm sorry. I didn't hear the last part of what you said.

DR. WALLIS: If you take one times E to the minus two and your CDF is E to the minus 2, then the action indicated may be far more severe than you are actually proposing to take, if you are going to throw around numbers like this.

MR. STROSNIDER: And I come back again to put this in the context of decision making under uncertainty. How strong should my action be to decide to understand the uncertainties associated with the potential for the initiating event? If I understand the consequences, that helps to tell me what I need to find out, and in this case we conclude we need to find that out.

DR. WALLIS: Your action has to be commensurate with the risk and, if you -- What I would like to see is how small does IE(f) have to be in order for the kind of actions that you propose to take to be commensurate with this risk.

MR. REINHART: I think you are raising good points. I think when I said this is a developing risk perspective, we are trying to put together what we can to just get ourselves a feel of where we are.

I think what Jack is saying is the bottom line of this slide. We know we need management attention. We have management attention. We have ongoing interest in the risk arena. We are trying to get information from industry.

We appreciate your comments, and we'll definitely feed those in there as we go through the next iteration of the --

DR. WALLIS: Yes, but you see, my concern is your attention -- the degree of your attention must depend on your assessment of what IE(f) is, and saying it could be one doesn't tell us anything.

MR. REINHART: Well, since we don't know -- See, we don't know what it is, and we're not saying that it is. We are saying --

DR. WALLIS: But that tells us nothing. If you are assuming it is one, then your attention may not be adequate.

MR. REINHART: What would you propose we say it is then? Maybe I'm misunderstanding.

DR. WALLIS: Well, if you are going to assume it's one and there's a core damage probability of E to the minus 2 for all these plants, that's not acceptable, is it?

MR. REINHART: We are not saying that that's the case. We are doing like a desktop scenario to try to get us --

DR. BONACA: I thought that those graphs were probably characterized as the probability of a small break LOCA will be still on the order of 10 to the minus 3. I mean, that's what we heard.

CHAIRMAN FORD: As I understand where you are right now is you are just trying to paint a worse case scenario, but you would answer the question do we shut all reactors down now. The answer is no.

MR. REINHART: Right.

DR. WALLIS: Why is it no?

MR. MARSH: Because the number is not one. It's 10 to the minus 3.

DR. WALLIS: That's silly. That's silly. If it is one, we shut them down, but it's not one. so we don't. That just tells you nothing.

MR. STROSNIDER: Let me try one last question here, and then I'll give up on it. But if the conditional core damage probability were 10 to the minus 6 as opposed to 10 to the minus 3 to 10 to the minus 2, would you have a different perspective on the discussion we are having today? That's the point we are trying to make.

DR. BONACA: And the point I wanted to make is that that may be actually one, if in fact this would result in rod ejection; and the strength is more in the IE that we heard this morning, that the probability of a small break LOCA resulting from these cracks in the nozzles was more on the order of 10 to the minus 3. That's what we heard, and if there is -- then still this is the order of what you expect for a small break LOCA.

MR. ROSEN: Take it for what it's worth, Jack. My original comment was that that's misleading, and I think this discussion -- and confusing -- This discussion makes that point.

DR. WALLIS: But I think that, logically, you should say, if you have 10 to the minus 6, you don't do anything. If it's 10 to the minus 4, you're satisfied. That means you have to take action to bring IE(f) down to 10 to the minus two.

MR. SIEBER: That's right.

DR. WALLIS: And you have to show somehow that all these things you are doing in this wordy way reaches that conclusion. I don't see any connection between the actions you propose to take, which sound reasonable, and the risk assessment.

DR. KRESS: I don't think it has to be 10 to the minus 2. Ten to the minus 1 would probably do it. You're talking about a time frame involved of a few years, and I personally believe there is significant evidence to pin down an initiating frequency a little better, because we have this susceptibility analysis.

I think that is a way to get to this initiating frequency, and I think it only has to be about .1 and not 10 to the minus 2.

DR. WALLIS: Whatever it has to be, there has to be some logical connection --

DR. KRESS: I agree with you on that. I think they have to pin that down a little better, because the action that they take should be commensurate with the risk. That's the only way you can figure out what the risk is. You have to pin that number down to some extent.

CHAIRMAN FORD: As an uninformed risk analysis guy, I don't understand it. It's very helpful to me to -- You have used this worst case scenario, and you're telling us, okay, guys, we are concerned. We are not so concerned we're going to shut the whole fleet down tomorrow, and it's not such a minor problem that we can walk away from it.

Now you are going through on your final --

you are going to go through and refine it.

DR. WALLIS: They have not given any evidence that there's no reason for concern. If you put down here if it's one and you get CDF -- What are you saying then? There's nothing here that says it's less than E to the -2.

MR. MARSH: It is only going to get better. He's already assuming the event.

MR. HACKETT: This is Ed Hackett. Let me try a slightly different spin on this, because I think where Dr. Wallis is going is sort of what process are we following to get there for this initiating event frequency.

In that regard, I think there are several encouraging things. I'll, hopefully, discuss a few of them in my presentation, but Larry presented earlier the elements of a probabilistic fracture mechanics assessment. I think that is what needs to be done here.

I think part of the problem and part of the problem with us answering Dr. Wallis' question here and struggling, obviously, is that we haven't done that. We are trying to, you know, sort of marshall the resources and get the process together to do that, but that's what needs to be done.

CHAIRMAN FORD: In fact, if you are going to cover part of that, may I suggest just from the point of view of timing, please go straight into your presentation, Ed, where hopefully you will cover some of these aspects.

MR. HACKETT: Sure.

CHAIRMAN FORD: Now I've managed to wrangle out another quarter of an hour from --

DR. BONACA: I want to say that the CCDP here in this context is still wrong. What I'm saying is that all you did, you took the IPEs and you look at the medium LOCA, and that's 10 to the minus 2, 10 to the minus 3, ignoring the potential consequences to core damage of the rod ejection.

DR. KRESS: Yes, you better take that seriously. You need to make the calculation and see what it is.

DR. BONACA: That's a true error to take the IPE medium LOCA, because here you don't have a medium LOCA. You have a rod ejection coming through. Okay? It may have no consequence. I haven't done the calculations. All I know, because I used to make some of these calculations myself, is that you may have some -- So just looking at the LOCA, conditional core damage is not enough.

MR. REINHART: We appreciate that comment.

MR. SIEBER: On the other hand, during the start-up of a PWR, the way you start it up, the chance of getting a big reactivity excursion in the source or intermediate range is relatively small, because you are so heavily borated, and you pull your rods out first to generally the bottom of the bite, and then --

DR. KRESS: Yes, but here you just got the opposite.

DR. BONACA: This break has been around here for a year and a half.

DR. KRESS: The boron is depleted down to a fairly low level.

DR. BONACA: I am making the point that don't ignore it. Just you have to look at it, this number here.

DR. KRESS: I think you can -- You don't want to have this event happen, even though it's probably not a catastrophic event from the standpoint of a LERF or damage to the public. I think it's within your design basis accent. You're not even going to exceed 10 CFR 100. But if this thing happened, you would have a real problem. I don't think anybody wants this to happen.

So I think you need to take Mario's

comments seriously and see what sort of -- You're not going to get extensive core damage, but you will get enough that you wouldn't want this to happen. So you better look at the neutronics and make a calculation to see what that does to you, that rod ejection, because I think he's absolutely right.

MR. REINHART: We have definitely written that down, and we will do that.

MR. HACKETT: I'll take off with what Office of Research was asked to do. I'm Ed Hackett. I'm Assistant Chief of the Materials Branch in the Office of Research.

(Slide change)

MR. HACKETT: This slide shows an overview of what NRR requested us to do and sort of some ongoing activities that we have.

We did form an independent group of experts, all of whom are here with one exception today. I'll talk about some preliminary conclusions and recommendations that came out of their work and some kind of integration of their work with what the staff has bee doing.

In addition, we have ongoing support to NRR that's -- Hopefully, I guess in the best of senses, it's transparent, but we have ongoing support to NRR that is in the areas that are specified here: EAC, non-destructive evaluation, structural integrity and fracture mechanics, and also PRA.

If the past is any indication, we are also planning on having our support principally in terms of our staff and contractors who are associated with non-destructive inspection technology being able to support inspection oversight activities for the upcoming outages.

(Slide change)

MR. HACKETT: The next slide -- I should point out, too, to try and stay consistent with Dr. Ford's request, I think there's a lot of this I can go over very quickly.

DR. WALLIS: It seems to me I looked at this. You ought to have someone who is going to tell you what the clues are likely to be, what kind of mass transfer and chemical events are likely to occur in these cracks and in these spaces. I don't see that expertise listed here.

MR. HACKETT: That is a good point, Dr. Wallis. Those are pieces that I think for the long term aspect of this problem need to be addressed. This group was put together largely to address some of the shorter term aspects, but I think we are going to get off into areas as you suggest as we go on. So we will hit those areas.

The folks who are on the independent group of experts, as I said, are all here right over at the table there to my right: Dr. Bill Shack, your colleague, from the Argonne National Lab on EAC; Dr. Steve Doctor from Pacific Northwest National Lab for NDE.

Gery Wilkowski and Richard Bass actually have collaborated a fair bit between leakage integrity and structural integrity. They are both here also.

The only non-PhD on the group, Mr. Mark Cunningham, couldn't be with us this afternoon, but basically I think Mark Reinhart has summarized what Mark would have said, had he been here.

(Slide change)

MR. HACKETT: The next slide shows what we asked the group to do. As Dr. Wallis was pointing out, there's really a short term and a long term aspect to this issue. We really at this point have been focused on the shorter term issue in terms of supporting NRR for the issuance of the generic communication, and also a little bit further afield for the guidance for the inspection activities for the fall outages.

Jack mentioned in his opening remarks, and I would like to echo that, that we are very satisfied with what we ar able to do, what the group is able to do in a very short time, and it's only about two weeks that they were able to pull together a fair amount of information that we are actually still in the process of digesting, and they are here to support us at this meeting today.

With that, I propose skipping over my slide five. I think we have pretty much beaten up the susceptibility evaluation, unless anyone has -- I don't think we have much to offer there at this point except to concur with a lot of what's been said.

DR. WALLIS: Well, what did the group of experts say about the industry model? Did they accept that? Did they not accept it?

(Slide change)

MR. HACKETT: The bottom line -- I'll just skip to that -- is the last bullet on the slide here. I think what it represents is the best shot you are going to get at this for right now.

DR. WALLIS: Is it good enough?

MR. HACKETT: I guess it remains to be seen. We are accepting it for now as sort of the best we got and, as Allen characterized in his presentation in trying to move on in terms of prioritization from there.

So, hopefully, the answer is yes, that it was good enough for that purpose, but I think only time is going to tell for sure.

(Slide change)

MR. HACKETT: In the area of EAC, we could spend a little bit more time at least. This is an area that, I think, a lot of the discussion here is focused on. It was a key driver or probably the key driver for this issue.

I think our consideration and speaking for the experts also is that the annulus region between the head and the VHP will be a site for concentration of aggressive chemical species. I don't think there is any doubt about that.

Also the initiation frequency and crack growth rates for the situation, as has been pointed out, are not known. We have not modeled that. That would be a very difficult thing to model. I think several of the ACRS members here have indicated what is really needed here is data.

I think this would be one of those cases where a couple of data points would be worth a thousand expert opinions, but we are not going to have that near term. Hopefully, that is something we are going to be working toward.

I think we consider that initiation at multiple sites around the circumference is likely, once you get this kind of phenomenon occurring. That, obviously, complicates the situation immensely. When you look at the implications of that on an effective crack growth rate, it could make the crack growth a lot faster.

DR. WALLIS: You mean, the thing looks like a sieve.

MR. HACKETT: The potential for at least multiple initiations, hopefully, wouldn't be quite a sieve, but I think the situation could be that it is cracked at a number of locations around the circumference.

I think the crack growth -- I'll elaborate on the last bullet, too. The crack growth rates in excess of one inch per year are certainly possible. Dr. Shack in his examination went a little bit further than that, and I'll just elaborate on that briefly.

He examined some literature data that was specific to vessel head penetration materials. Albeit it is a limited dataset, but in looking at that and attempting to bound the crack growth rates in that data, what Bill found is an indication of a crack growth rate on the order of 30 millimeters per year. It's a little bit over an inch per year.

In contrast with, I think, the industry's submittal or response to NRR's recent set of questions was indicating more about half that growth rate, maybe about 15 millimeters per year. I think Bill in his analysis indicated that that would represent more of a 30 percentile type number, if that sounds right, Bill.

DR. KRESS: But you would still have three more years before Oconee has a ligament problem?

MR. HACKETT: Well, the complicating feature there is the fact that these also only address PWSCC conditions, existing data. There has been an awful lot of speculation and discussion here about what this concentration of the chemical species in the crevice would do.

I think everyone would probably consider it would make the situation worse. So the $64 question is how much worse. We don't know the answer to that right now.

MR. HISER: Actually, it would be half that, because you have two tips growing. So it is effectively the equivalent of two inches.

DR. WALLIS: There is no two-tip, because you have multiple sites.

MR. HACKETT: It could be more. It could even be more than two.

DR. SHACK: Now again when I did that, I came up with -- Even for the PWSCC, there's a distribution of crack growth rates. It depends on the heats of material. It sort of looks log normal. You know, we said it was log normal. It even looks log normal.

The one inch per year is kind of like the 98 percentile, and go to what industry's model is. It was -- a log normal distribution, something like a 33 percentile. So there is a distribution of rates, but the one inch per year is -- I consider 98 percentile an upper bound.

CHAIRMAN FORD: Well, now you've got the interesting situation. It's exactly analogous to data that was available for low alloy steel pressure vessels. You've got an enormous crack propagation rate, which you can't live with.

So how do you regulate that? How would you regulate that, which is the situation?

MR. HACKETT: That is what -- Maybe if we could hold that to the end, I'll try and come to that.

I think at least it's unfortunate I have to go this far to make that kind of case, but one of the things that would argue for the fact that they are not fast is we haven't seen anything.

We haven't seen penetration accidents, you know, worldwide at this point. So they are probably not that fast, but we don't have the data to show it at this point.

One other point I wanted to make in this area is another point that Dr. Shack brought out in his analysis. We didn't discuss this much earlier today, but a limiting step as regards the environment here is likely to be the initiation in through-wall growth or through-weld growth on the J-groove weld.

One of the things you could look at, and I think Dr. Wallis was going to this earlier, was the situation with the welds are likely to be more variable for all the usual reasons that metallurgists would offer, and the bottom line is -- So you are likely to see a lot of variability and shouldn't be surprised in that, you know, one happened at Oconee in one location and didn't happen in other places. But then you get the propagation -- or you get the initiation and propagation to that J-groove weld. Now you have a much more uniform population of vessel head penetration housings.

Then you are probably going to start to see a fairly aggressive attack fairly fast after that. So I'll come back to this in the examination aspect, but I think what it points to is that's a limiting step, and that maybe needs to be a bit of a focus for some of the non-destructive examinations.

I would also propose in the interest of time skipping the next slide, because I think we covered the boric acid deposit annulus leakage issue.

DR. WALLIS: There was a question about what you learn when you see boric acid deposit in terms of what is happening inside and how sure you can be about what is happening inside from the amount of boric acid you see on the outside. That connection needs to be made.

MR. HACKETT: I would agree, and it has not been drawn conclusively. I think I would tend to concur with a lot of what I heard here this morning, in that from what we have seen and what the experts have said, what is going to happen is you are going from a very tight PWSCC crack in a J-groove weld into this relative -- I think Bill referred to a relative chasm of an annulus, and you are going to flash right there.

There's a huge delta P across there, and you are going to start the concentration at that point. So from the standpoint of what that means to the EAC part of it, it is obvious that you are concentrating a species.

What it is going to do with regard to the accumulation of boric acid crystals and what makes it way out, I think, is a much more complicated issue. I think it is obviously highly uncertain as to exactly what is going to come out of there at this point.

So maybe I'll just summarize by saying that without going through the slide.

(Slide change)

MR. HACKETT: Another important aspect that we will be coming up on, once we get through the near term focus on the issuance of the generic communication is the issue with the inspections, and that's been very thoroughly covered today, too.

Just to reiterate some of it, I think volumetric examinations are indicated for plants with known cracking. Allen covered that. It depends on how you take the meaning of preferred, but I think it would be the preferred inspection method for high susceptibility plants in general, but that remains to be seen, what's going to be done.

The vendors: It is known, obviously, that there are current equipment capabilities, but as Larry pointed out, not currently qualified inspection methods for the OD phenomenon.

I think it's fair to say the inspections can be effective, if adequate pre-qualifications can be performed. But then you are going to be down to the issue of the limitations on the number of methods, likely to be UT methods, and teams that could be field for these fall outages.

I think industry has talked about estimates on the order of four or five teams that might be able to be fielded potentially, or maybe it's not even that high. That is, obviously, something that needs to be looked at hard.

The other point I would add to this that I didn't get on the slide is back to this inspection of the J-groove welds. I think a combination of Bill's write-up along with Steve Doctor's would be indicating that that could be a very pacing item here.

If you are going in looking in the fall outages with the method that you are going to be looking under the head -- and let's just take the scenario where you find a crack in a J-groove weld, but you don't seem to find cracks in the housing. I still think that is going to be a situation where people aren't going to rest real easy.

Once you are cracking through that J-groove weld, I think you are going to start to have some problems pretty quick. So looking at the J-groove welds then, you have to talk about -- There was some discussion earlier. That's obviously a very difficult inspection.

Penetrant exams are a possibility but, you know, you have dose considerations unless you can do that in an automated sense. Probably more likely are eddy current or UT, if that kind of tooling can be developed.

At any rate, I think there is a recommendation there that that would probably be a good thing to focus on.

(Slide change)

MR. HACKETT: We were also asked, and the group was asked to comment on online monitoring for leakage or cracking. This is an interesting area, because the bottom line is it is technically feasible. It has been demonstrated, especially abroad. There is an online leakage monitoring system that EDF is employing at right now, I believe, about 25 of the French plants that uses N-13 monitoring. It is supposedly effective down to one liter per hour type of leak rates.

Acoustic emission monitoring has been demonstrated in this country in nuclear plant applications for identifying cracking in plants.

DR. WALLIS: This is a whistling?

MR. HACKETT: Basically, you are looking -- It's an acoustic signal that you would get from the crack propagation or initiation.

DR. WALLIS: It's from the crack? It's not from the steam squirting through?

MR. SIEBER: It's the fluid. You can't hear the crack.

DR. WALLIS; It's the steam squirting through.

MR. SIEBER: All these are very gross kinds of things. If you are talking about a gallon per year or a gallon per month, acoustics isn't going to find it. N-13 will not find it or N-16. You can't find it by radiation, because if you are sitting right on the reactor head, it's pretty hot there.

MR. HACKETT: Dr. Sieber goes exactly to one of the conclusions that the industry reached in their response to the NRC, is that a lot of these would have some real problems in the --

MR. SIEBER: I can't see how you would do it.

MR. HACKETT: In addition to that, even if they are feasible, the last bullet, I think, applies. It's probably not going to be anything that is going to be impacting U.S. plants in the near term. It would require a longer term development effort.

Obviously, EDF and the French regulator concurred that they thought it was a workable situation for their plants. I think it would remain to be seen, and it would be the industry's decision whether to employ that sort of thing.

(Slide change)

MR. HACKETT: Cutting to structural margin and trying to get to this conclusion we have been talking about, a couple of things. The expert group, in addition to some of the staff, have basically verified the structural margin calculations by the industry, and that is to say Inconel 600 is a very flaw tolerant material, especially in the forged version.

It can tolerate very large through-wall circumferential cracks while still maintaining the structural margins. As pointed out earlier, the margin calculations don't really consider the crack growth or the time effect.

I think what, obviously, this is all crying out for in trying to integrate the conversation that was occurring previously is what is lacking from our side and the industry's side, I think, in a lot of cases, for lack of some appropriate data, is an integrated assessment of the structural integrity that would address the EAC.

Really, a lot of it is the linkage between the environmentally assisted cracking and the residual stress state that exists around the circumference of the penetrations, and also the inspections, what you can and can't do in terms of the future outages.

I think my own assessment of this, and I was glad to see that in the industry's response, is this really needs to be done in a probabilistic sense. I think the code they would likely use for this, also that the NRC has employed before, is PC PRAISE.

We employ a very similar methodology for accepting different phenomenon, and we've talked to the Committee before about pressurized thermal shock, and there we employ a probabilistic fracture mechanics assessment that uses the code FAVOR, which was developed at the Oak Ridge Laboratory.

That is really what needs to be done here, because you are dealing with an overwhelming number of variables to be assessed here. It has to be fundamentally done in a probabilistic sense that would, hopefully, get you at an initiating event frequency within some reasonable margin of uncertainty. That's where we are not right now.

I think, obviously, as Jack was indicating, the expectation on the part of the staff is that this thing is obviously not an event frequency of one. It is, hopefully, significantly less.

I think what we can't do is say we think it is this number as a median number with about this uncertainty band. So that is, hopefully, what we are driving toward.

DR. WALLIS; How do you get probabilistic information for this of aggressive chemical attack when you don't have any data?

MR. HACKETT: That is a real good question. I think, as you mentioned earlier, there are some assumptions you could make. I know some industry experts might be able to comment on this even more eloquently, but they employed a code previously in some evaluations for BWRs called VIPER, which did get into probabilistic aspects of the chemical species for BWRs.

So it can be done. Some assumptions have to be made. It's nicer still if you have the data. I think in the near term, we are obviously not going to have that data. So that will be one area where we will have to make some assumptions and then try and integrate this whole thing.

I guess that's what I would say in that regard.

(Slide change)

MR. HACKETT: Then in, I guess, sort of the summary -- and I guess I said a lot of this already. So what are we doing?

We are developing -- trying to develop this integrated perspective and, as Jack mentioned, a lot of this will rely on ongoing dialogue with the industry and consideration of the expert group reports and other analyses.

We are going to put this integrated -- the short term version, at any rate, the integrated perspective would be documented in a memorandum that we would be proposing right now would go from Jack Strosnider and Mike Mayfield, the two respective division directors in Offices of NRR and Research, to their office directors.

We will, hopefully -- I think more than

hopefully. We'd better have it done this month. I don't think we really have anymore time than that. That will be made public once we get that through concurrence.

What I would add, too, is that perspectives and recommendations from what I've been talking about here have been factored in, in an online sense, into what's gone into the generic communication.

The last bullet then: It is not anticipated that any further technical evaluation in the near term here would have a significant impact on the communication, but would, obviously, I think, in this case influence development of longer term programs for dealing with the issue.

I think Ill just conclude with that and see if there are any questions. If not, I'll turn it over to Tad.

DR. WALLIS: You talked about an integrated assessment of everything, the chemistry and the flow and everything. Will we ever see some kind of presentation on this, so that people understand it?

MR. HACKETT: I would hope so. I guess the timing is what is going to be key. I know Larry had indicated in his presentation that they were driving toward having a lot of this work done by, I think he said, end of the calendar year.

So somewhere -- It won't be within the next couple of months, I think, but maybe we would be looking at coming back before the Committee early 2002 calendar year to be able to try and look back at this and here's the kind of integrated perspective we can bring to the thing, like we, hopefully, are able to do now with pressurized thermal shock, but hopefully, it won't take us as long, because PTS has been a long time in the coming. We will try and do it quicker this time.

CHAIRMAN FORD: Any other comments? Okay. Thanks, Ed. Thank you very much.

MR. MARSH: Mr. Chairman, I had a brilliant and highly informative presentation to make.

CHAIRMAN FORD: We have been allowed to go on until quarter to three, but I do want to spend a quarter of an hour in general discussion and getting some advice.

MR. MARSH: Okay. Well, let me proceed. My name is Tad Marsh, and I'm Chief of the --

CHAIRMAN FORD: If you could just try --

MR. MARSH: Five, ten minutes? Fine.

I'm Chief of the Operational Experience

and Non-Power Reactors Branch, and I have the programmatic responsibility for generic communications.

(Slide change)

MR. MARSH: This part of the presentation today was meant to step back from the technical and talk about the process: Where are we in terms of generic communications?

I'm going to breeze through some of these slides pretty quickly. What I would like you to get from the first slide is that the agency made some substantive changes in the generic communication process in 1999, and there is a SECY paper, 99-143, which describes them.

Among the things that we did, we added more rigor into our process. We added some more vehicles, a regulatory issues summary, and we added some other features which I will ask you to go take a look at that SECY paper, if you would like.

(Slide change)

MR. MARSH: The next couple of slides talk about the vehicles themselves, bulletins and generic letters specifically, because those are the regulatory vehicles that require information back.

(Slide change)

MR. MARSH: As a process matter, generic communications cannot require anything beyond responding. They cannot require a plant change. They can't require a plant shutdown. They can only require information back. They can request actions. They can request information, but they can only require responses back.

(Slide change)

MR. MARSH: If we were in the mode of requiring actions, we would be in the mode of a rule or an order, and we are not in that space. We are in the generic communication space. But it is important to note that, in terms of generic communications, this is the highest vehicle that we've got. A bulletin is the document that conveys the most significance. So from a perspective of significance, that is where we are.

(Slide change)

MR. MARSH: I'd like you to understand a little more about the differences between a generic letter and a bulletin, because the staff at one point was considering a generic letter. Since we were seeking information, another vehicle is to use a generic letter as opposed to a bulletin.

Setting aside that the bulletin conveys

more safety significance and more importance, which is the first major difference between the two, generic letters also take much more time.

This is a much more public part of the process. We put it out for public comment. We get comments back. We convey those comments up to the Commission. It's a much more protracted environment.

As a benchmark, bulletins should take on the order of eight to ten weeks, being as expedient as you can. There are ways to make that even shorter, but in order to go through all the hoops that you need to do, about eight to ten weeks for a bulletin.

A generic letter, on the other hand, can take five to six months and more, depending upon what happens, depending upon the comments that you get, depending upon the interactions with the Commission, etcetera.

So you can see an order of magnitude difference in terms of the documents and how long they take.

Another key ingredient in this process is that in a generic letter our procedure says the first thing you do after you get permission to proceed pursuing a safety matter is interact with the industry.

Whatever venue that may take, whatever organization is that's responsible for this issue, you interact with them, the thrust being let's try to get a cooperative arrangement to solve the technical problem without relying on a generic communication or some sort. That's the first step, and that has taken place here.

In fact, the staff has been working for roughly six months with the MRP on this issue, thinking that we would reach a resolution pathway. At some point, we diverted. We decided that we needed to take a regulatory action beyond relying on the industry for information.

That occurred probably two months ago when we had several REIs. The questions and commitments and things were not reaching to a timely resolution. We went to a different track, a regulatory track, and the track demanded more action on our part. So that's the pathway that we are on.

(Slide change)

MR. MARSH: There is a diagram in the back which comes from the SECY paper which has that process, that generic communication process, working with the industry, etcetera. What it lacks in that diagram is feedback loops, because we did go from a generic letter route to a bulletin route.

Any questions before I launch on to what we have been doing? Okay.

(Slide change)

MR. MARSH: I am going to skip the next slide 5, which talks about requests for action, requests for information. If we had more time, I would like you to understand how we get to the various documents themselves.

I do want to talk about milestones, because the staff has been working aggressively with the industry in trying to come to resolution on these issues.

You've heard a lot of this, but this is, more or less, the sequence of steps that have been taken, interactions that have taken place. Key, I think, is many, many meetings, many public meetings with the MRP, and we are sensitive to that, because we have jumped over into a bulletin space, which is not as public a process as a generic letter. But we have had many public interactions, and I think those have worked.

We issued an information notice, which is another one of our regulatory vehicles, in April this year, and we conveyed results of the Oconee Unit 3 results. We have had various REIs back and forth on trying to seek more information.

(Slide change)

MR. MARSH: On Slide 7 I would like you to see that we briefed the Commissioner of Technical Assistance two times. That is important, because we wanted to keep the Commission informed.

We indicated publicly in early June that we were headed toward a generic communication. In other words, we needed to take a more aggressive regulatory approach. We did that through a communication with NEI and through a public meeting and through meeting announcements. That occurred prior to the June 7th meeting.

That June 7th meeting, which was an important meeting, conveyed to the industry that we were concerned enough that we were headed for some type of communication. We were unsure what type at that point.

Then June 11: Ed has talked about the experts that have been convened through Research which were helping NRR in this regard. We have briefed CRGR once, July 2nd. That was a pre-brief. It is unsure whether we are going to have the formal brief, because they may be satisfied with the mark-up of the document coming from this discussion and coming from our own management discussions. So we believe we are in good shape with respect to the CRGR.

We also had a public meeting in July.

(Slide change)

MR. MARSH: Next and last slide talks about the steps that are in front of us. Today ACRS Subcommittee and tomorrow's full Committee meeting are key. As I say, we may have a CRGR meeting, a follow-on meeting, if they so choose.

We do seek a letter from you with any comments or suggestions that you may have, and we need CRGR endorsement. That is a requirement for a bulletin.

I should say you can not have CRGR endorsement, but it needs to be particularly urgent, and they ask that you come back to them following the issuance of a generic letter or a bulletin, if that's the route. In this case, we seek them in advance, and we have been keeping them informed.

We will be issuing a Commission information paper, and there is normally a ten-day time period where we wait for any comments they may have, and we will be issuing the bulletin, hopefully, by August 1st, which if you look at the agency's generic communication record lately, the last couple, three years, this is the first bulletin that we have issued since '97.

There's lots of reasons why that generic communications have dwindled in numbers, part of which we think the process has improved. But in terms of a time frame, I think eight weeks to ten weeks is the right time frame for something of this significance, and it speaks well, I think, for how we've been doing for addressing the issue.

That concludes my comments.

CHAIRMAN FORD: Tad, thank you very much indeed. I'd like to open up the meeting now for some general comments. Steve, you said you had some questions and comments.

MR. ROSEN: I have one. After listening to all this, it occurs to me that the aging management implications for plants that have applied for or indicated that they will apply for license renewal are important. What are your thoughts in that area?

MR. STROSNIDER: This is Jack Strosnider. I believe the Committee actually -- on one of the last licenses that was issued actually addressed this issue in their letter. If I can characterize the bottom line, it was this issue is going to have to be dealt with during the current licensing period, and whatever comes out of it that people would have to follow.

When you look at the time frame for when the renewed licenses actually go into effect, we expect that this issue has -- It has to be dealt with before that, and that was -- I want to be careful, because I don't want to put words in the mouth of the Committee, but that was my recollection of the message.

DR. BONACA: Our thought was there is no plan in place that we can put -- that will predict what may happen to some component, you know, 40 years of life. All we can expect, however, is that programs are in place that would provide inspections timely and be insightful enough to identify the gradient degradation mechanism and provide corrective actions.

MR. STROSNIDER: Let me add one thing to what I said earlier. You know, what we are talking about today with regard to this bulletin is really a one-time sort of a snapshot in time: Let's deal with the short term.

There is a recognition by the staff and by the industry that there needs to be a long term program put in place. In fact, the ASME code already has a group off looking at this, and we'll be pushing for some longer term augmented program that will address this. But when I say longer term, it's not that long. It's not all through license renewal period. It's much sooner than that.

CHAIRMAN FORD: Any other questions?

MR. SIEBER: General comment?

CHAIRMAN FORD: General comments, yes.

MR. SIEBER: I can offer a few things. First of all, I think that using the bulletin format was the way to go for this issue. So the choice is right, probably the simplest one, considering the fact that I think the issue is relatively urgent.

I concur with Dr. Wallis that there seems to be a lot of uncertainty in the machinations that were gone through to determine susceptibility ranking and phenomenologically describe actually what is going on.

So when I look at the data in view of my not very good feeling about the certainty of the rankings, I wonder why one would pick four years as a cutoff point for that second group of reactors rather than ten years. Seems to be a sort of a logical break point at ten years. That would pull in double the amount of plants in that period of time. So perhaps there is an answer to that.

I think another question that comes up is the idea of collateral damage, if you would get a circumferential crack. It seems to me that since the CRDM housing is unsupported at one end, that crack when it got to 280-290 degrees, the remaining ligament would act like a hinge, and rather than just blow off, it would probably take the direction that the hinge would allow it to take. The only restraining thing would be the drive shaft that remains inside the tube.

So I think that's an issue that needs to be looked at as to whether that is likely and, if it is, would the adjacent rods have dropped prior to damage to any other housing. I sort of doubt that it would fracture another housing, but I'm not sure that it wouldn't bend on it.

So I think that that, to me, is a concern, and it's because of the geometry and the fact that it's not supported at one end. I've seen some circumferential cracks that finally broke in pipes that gave that hinge effect. It just sort of goes off to the side. So I think that that's an issue.

I would feel much more comfortable if a lot of these uncertainties and analyses that haven't been done were completed so that, even though the bulletin would go out, I think that we would profit from having more knowledge about probabilistic fracture mechanics and this geometry and what the spread of the data is and just exactly how well, with how much certainty, are all these factors established.

I think that that's a pretty good concern of mine. But otherwise, I think that, in light of what we know and what the industry has seen and reported, I think that the issuance of the bulletin is a good idea, and you've got to try to keep to your schedule.

One other comment. I'm familiar with weld repairs under Section 11. I wonder that, if you had a through-wall crack in a J-weld and you repair it by grinding it out and then doing -- you know, basically welding it back shut -- what do you do with all the boron crystals that are in this interference fit above it, and how does that affect the remaining life of whatever is in that nozzle area? Does that make the nozzle much more susceptible? Is there a way to clean it out, because you know it's going to be there?

DR. KRESS: Steam it.

MR. SIEBER: Well, you may get more steam than you want there, if you know what I mean. Anyway, that's a concern that I would have with weld repair under the code where you are, in effect, putting a canopy weld on with a long manufacturing crack right above it. So I don't know. Maybe somebody could answer that for me now or later.

Those would be my concerns.

CHAIRMAN FORD: Graham?

MR. LEITCH: I guess the acceptability f this whole approach, to me, seems to lie best on three principal legs. One is that the time-temperature relationship will identify susceptible plants, and I think, in spite of the uncertainties in that information, I think the fact that the plants -- that it would have identified the plants that actually have the cracks gives me some confidence there, although I don't know complete confidence. It does seem to be kind of the best that we could do at the moment, based on the data that is at hand.

The other major thing in my mind is that the boron crystals will be a telltale sign that we have a crack below that, as a visual examination looking for boron will tell us what we need to know.

I guess there I have a fair amount of confidence that even small leaks will, even through this interference fit, likely yield boron crystals that will be amenable to visual observation.

The third leg of the stool in my mind is that we understand crack growth rate. I guess there my confidence is least among these three areas. I just don't have a good feel that we really understand how fast these cracks can go.

I have had some experience that seems to suggest that the growth rate may not be linear. That is that the cracks may suddenly grow and then stop and then grow again and then stop, that there is some nonlinearity to this growth, particularly in an environment where we don't quite understand exactly what the environment is in this tight annulus or in these cracks.

So I guess, to sum up my comments, I would just say that I am most concerned about our understanding of crack growth rate and what that suggests for the frequency of inspections and future plans. But I think you are on the right path to accumulate that information and get as much data as we can and see where we go from there.

DR. KRESS: My view is very much like what Graham Leitch just expressed. I really think we can buy off on the susceptibility analysis, time and temperature.

I think it should be -- Some attempt should be made to look at the variability of the other variables in there, the materials and the stress and so forth, to try to estimate the possible ranges of uncertainty in that. But I think that will probably be an acceptable way to determine the susceptibility and, therefore, to choose which plants to look at first.

I share Graham's view that the growth rate is of concern. There, I think you need to maybe utilize the early inspections of the plants in such a way that you can actually use it as data to determine that growth rate. Several inspections of a -- You know, when you find a crack in one of the plants like Oconee, do something about your inspection frequency to try to see if you can extract the growth rate out of that.

I think it would be useful to do some of Graham Wallis' analyses which are primarily thermal hydraulics to determine what the chemical environment is in that annulus and in the crack itself as a way to understand the growth rate or at least to have additional data at your fingertips.

So I would encourage you to try to do some. They are relatively simple. You know, it's not a big effort to do that particular calculation. So I think I would encourage that.

I think the inspection process could be thought of as a graded thing. As you do these early ones and you don't find much, you may want to relax how fast you do the others and which ones you draw in, but that's something you can decide later on after you see what you get with the first ones there.

I think you need to do some looking at validating the reactivity insertion effects that Mario brought up. I'm pretty sure that design basis reactivity insertion calculations that have usually been made in the first place are probably okay, and they tell you you are not going to exceed 10 CFR 100, and that should really be all NRC is concerned with. The utilities may be worried about more than that.

What bothers me there is I'm not sure it is just one rod, and I worried about the concept that Jack Sieber brought up about can we really be sure it's just one rod, and do those design basis analyses use the right energy level for the insertion? Do they rely on keeping below an energy level that you don't disperse the fuel and, if so, has that properly factored in the burnup effect that we have seen recently.

Maybe one needs to relook at that part of it when one looks at the reactivity insertion rate.

That's pretty much my comments.

CHAIRMAN FORD: Mario, do you have anything extra to say? Oh, I'm sorry, Steve. I'm sorry, I thought you had finished.

MR. ROSEN; No, I had one more point I would like to make, Peter.

My view is that regulatory compliance issues notwithstanding, I think the staff needs to put a high priority on the risk estimate. What they really need to do -- Tom was alluding to this -- is to track through with the best estimate way you can what would really happen if we had a full circumferential crack of one of these housings, so that we can really put this issue in context for ourselves, the industry and the public.

DR. BONACA: I can only second what I heard before. I agree with those points of view. Again, on the issue of rod ejection, I think, Tom, you expressed the whole thought of collateral damage here and the point that Jack took was very well described there. It is an issue that you have to look at, and just to have an appreciation for the potential issue of it. What is the whole separate issue?

The other issue that I think -- You know, in general when I look at the program presented here by the industry and by the NRC, I feel comfortable with that, with one exception. I mean, and I'm sure you share this, the effectiveness of the visual inspection. So I raised that issue before.

You are going to go there and look at these plants. The number of plants you are going to look at is a good number, is a solid number. It's in excess of 20, but you know, the only question is what are we going to learn from this?

You know, I didn't get out of this meeting with a warm feeling that, you know, we will look and find. I think in some cases we won't. So we are left still with that question of, you know, given the condition of the head and the insulation and so on and so forth, we'll have to learn how comfortable we can be.

DR. KRESS: I think we have to take comfort that Oconee didn't break before they saw something. It leaked before a break.

DR. BONACA: I agree. I agree with that.

DR. KRESS: And I think that is the comfort level you have to assume.

DR. BONACA: Yes. I'm only -- You know, we'll have to see in the next few months what we learn about the inspections and the visual and effectiveness of the visual inspections.

CHAIRMAN FORD: Bob?

DR. UHRIG: Well, I guess I have some concerns about the time-temperature model. My concern here is the fact that the three Oconee plants came out at the top of the list. Top priority may be fortuitous more than related to the model itself.

It reminds me a little bit of my graduate school days when they said you could fit any set of data with a straight line on log-log paper.

I am concerned here that this alignment of plants here -- and a little bit was expressed over here. Why not go out ten years, not four years. I think that whole group of high temperature plants, if you want to call them that, particularly the older ones, are prime candidates for inspection at the first opportunity.

Also one other last comment would be: There may be some foreign technology out there available in terms of sensors and ways of inspection that would be useful, and it ought to be looked at.

CHAIRMAN FORD: Thank you.

DR. WALLIS: Well, you have heard some of my concerns. There are really two things. One is knowing where we are, and then the other is knowing what to do.

In terms of knowing where we are, I feel that the risk analysis didn't tell us anything, and we really need to have some estimate of this 1-EF, even if it's difficult.

Of course, there are questions about the integration of the flows, the chemistry, the leaks, the cracks and so on. There's been too much emphasis on the crack. I think there's a whole lot of integrated phenomena gong on here we've just begun to understand.

So knowing where we are is subject to a lot of uncertainties there. Of course, other questions have been raised, and my colleagues have raised them.

I guess what you are looking for is comments on whether the action proposed is appropriate, whether the bulletin is the right approach, whether what's in the bulletin is right. That would, I think, require a study that I haven't yet made of what actually is in the bulletin, and somehow trying to link that to what I think we know technically.

That's where personally I feel a little uncertain. I mean, I can comment technically about flows and chemistry and stuff, but then the regulatory environment for someone like me is always a somewhat arcane one, and whether or not this is appropriate regulatory action is difficult for me to assess. But I guess we have to do that, because that's the main question.

So I guess we will address that tomorrow unless we write a letter. I've got to somehow make the link between these technical things and what I think I know and think you don't know, and whether this is the appropriate thing to do in the near term and in the longer term. That's where I think we have some thinking to do.

CHAIRMAN FORD: I think, summarizing, as there are only three minutes to go: I think my advice for tomorrow is, bearing in mind that what we are going to try and convince the whole ACRS Committee, that what I think you are hoping for is a supportive letter to say the bulletin is the way to go, and I don't think there is going to be any argument that that is true.

There will be a whole lot of technical questions, and we will be all brought up very, very similar technical questions, in the short time available at the meeting tomorrow just to focus on those, and then heard about the inspection and how good is the inspection. Is visual inspections worth it? Obviously, it's one thing to do, but should we be putting efforts into other areas?

The question of crack growth rates: What the environment is, things of this nature. And then there's the risk assessment that came up. Are we absolutely sure that we should not be shutting the reactors down right now? I don't think that is the case. That's a worst case scenario.

Is the time-temperature histograms that we've been using -- is that an adequate way to prioritize inspections? That's the thing that needs to be addressed in a bit more detail, to the exclusion of some of the other things, given the short time that we have.

DR. KRESS: And Dana is -- we are sure going to ask his opinion.

CHAIRMAN FORD: About this question of the --

DR. KRESS: Maybe we want to be prepared to answer it.

CHAIRMAN FORD: There will be certainly a question from Dana Powers on the whole question of the SCRAM and --

DR. KRESS: Reactivity and failure to SCRAM.

MR. HACKETT: Failure to SCRAM in the LOCA, right?

CHAIRMAN FORD: That question, for sure, will come up. Are there any other last minute questions. Jack, do you have --

DR. WALLIS: I have another view, too. This is just today. This is an ongoing drama, and I expect that we will learn a lot in the next few months.

CHAIRMAN FORD: Oh, yes. You know, the thing that is really going to encourage me is the interaction between you and Research. They did not give me any forewarning as to the things they were going to talk about, and I find it very encouraging that you got a real good group of experts that are coming up with the answers.

I'm sorry. I'm talking to jack there. You have heard all the questions, obviously. You can address this.

On that issue, Mag, how much time have they got? Do you know? Tomorrow?

MS. WESTON: Each group will have 15 to 20 minutes only. The other amount of time should be reserved for discussion and additional questions that the Committee may have to wrap up the issue before they write the letter.

CHAIRMAN FORD: Okay. Are there any last minute comments, questions? Okay, thank you very much.

MR. HACKETT: Chairman Ford, if I could just a second -- Sorry about that.

There were just two I wanted to leave you guys with, because I think two very important comments were made, and one part I forgot to mention on the crack growth rates.

Several of you brought up crack growth rates. One of the things that would happen here, depending on the cracking phenomenology, if it goes through-wall preferentially going around the circumference, then you tend to move yourself back to a PWSCC environment because of the reservoir of the primary system.

Anyway, that's just something for folks to think about.

The last part was what Dr. Uhrig raised, and I could echo that. The Europeans, we believe, are probably significantly ahead on this issue in terms of inspection capabilities from some of what we have seen.

So there is some information to be gleaned out of that, too. Sorry about that.

CHAIRMAN FORD: Thanks very much.

(Whereupon, the foregoing matter went off the record at 2:47 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: ACRS Joint Meeting

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

John Mongoven
Official Reporter
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